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Schopf et al.

(10) **Patent No.: US 9,322,161 B2**
(45) **Date of Patent: Apr. 26, 2016**

(54) **CLAMPS FOR PANELS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(22) PCT Filed: **Sep. 10, 2012**

(86) PCT No.: **PCT/IB2012/001740**

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(2), (4) Date: **Aug. 29, 2014**

(87) PCT Pub. No.: **WO2013/034973**

PCT Pub. Date: **Mar. 14, 2013**

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Sep. 8, 2011	(AU)	2011903654
Oct. 10, 2011	(AU)	2011904258
Aug. 10, 2012	(AU)	2012903448

(51) **Int. Cl.**

E04B 1/38	(2006.01)
E04C 5/00	(2006.01)
E04B 1/41	(2006.01)
E04F 11/18	(2006.01)
F16B 2/12	(2006.01)
E06B 3/58	(2006.01)
F16B 2/10	(2006.01)
F16B 2/06	(2006.01)

(52) **U.S. Cl.**

CPC ***E04B 1/4107*** (2013.01); ***E04B 1/38*** (2013.01); ***E04F 11/1851*** (2013.01); ***F16B 2/06*** (2013.01); *E06B 3/5864* (2013.01); *F16B 2/065* (2013.01);

(Continued)

(58) **Field of Classification Search**

CPC F16B 2/06; F16B 2/12; F16B 2/065; F16B 2/10; E04B 1/4107; E06B 3/5864; Y10T 29/49826

USPC 52/713, 712, 711, 474, 489.1, 489.2, 52/775, 767, 778, 127.12, 127.11, 127.9, 52/DIG. 1; 269/297; 254/131, 134

See application file for complete search history.

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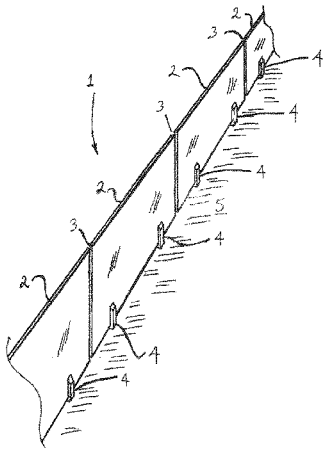
Primary Examiner — Chi Q Nguyen

(74) *Attorney, Agent, or Firm* — Hogan Lovells US LLP

(57) **ABSTRACT**

The present application discloses improvements to support clamps for panels of glass and the like. An arrangement of two clamping halves (**9000**) each having a clamping surface (**9001**) and a locating component (**9070**) interlocking the two halves. Each of the two clamping surfaces are brought together by movement of the locating component through a range of positions, preferably lengthwise, such that portions of them are urged apart thus pressing together the clamping surfaces and securing the panel. In addition the first and second clamp halves include each an opening for a fastener (**7014**) within a flange (**7010**, **7012**) such that the second opening is oriented approximately perpendicular to the first opening.

10 Claims, 27 Drawing Sheets



(52) **U.S. Cl.**
CPC *F16B 2/10* (2013.01); *F16B 2/12* (2013.01); *Y10T 29/49826* (2015.01)

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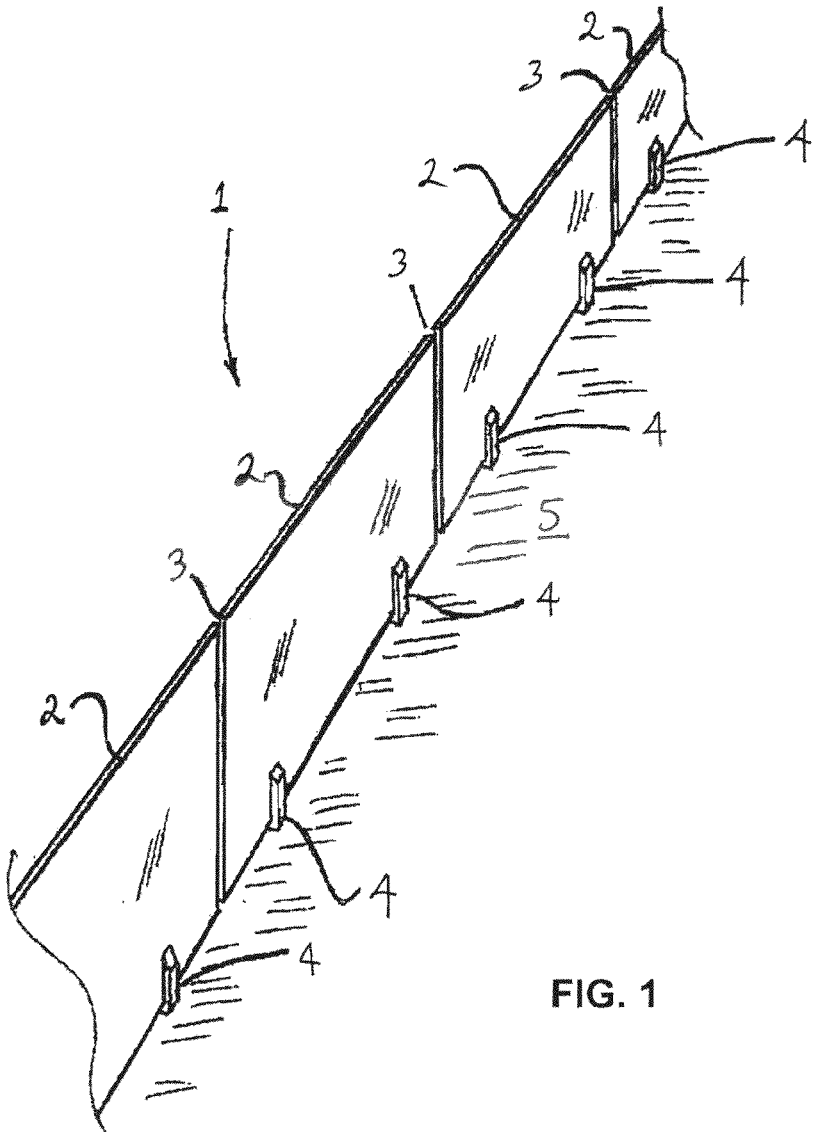

FIG. 1

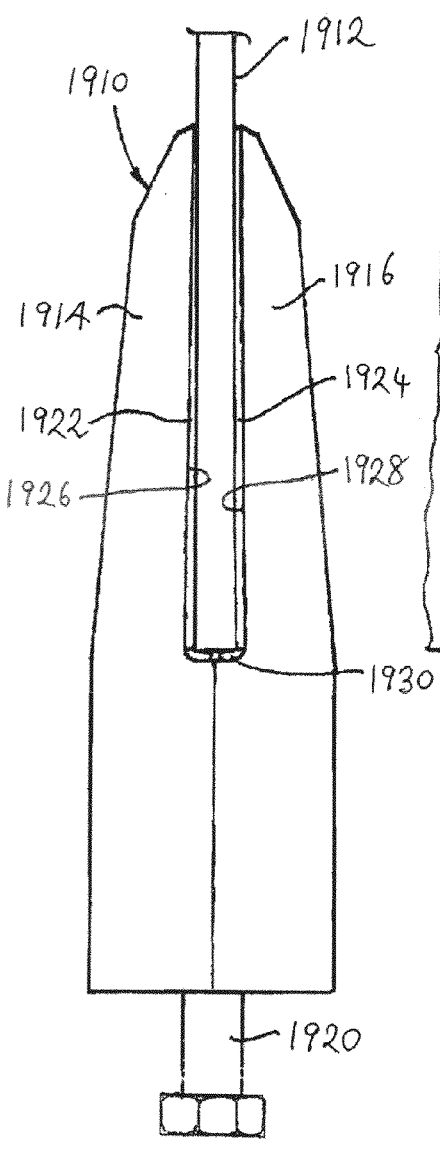
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FIG. 2

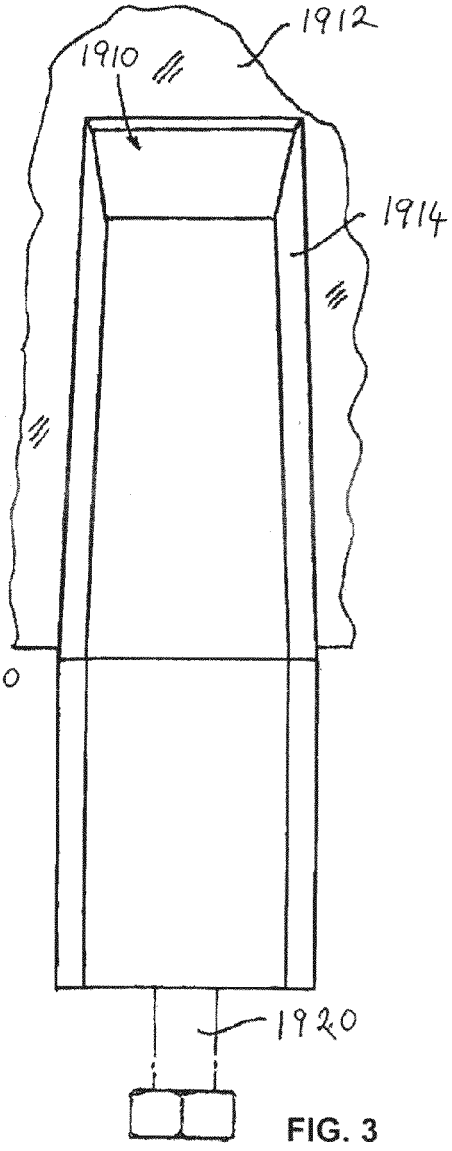
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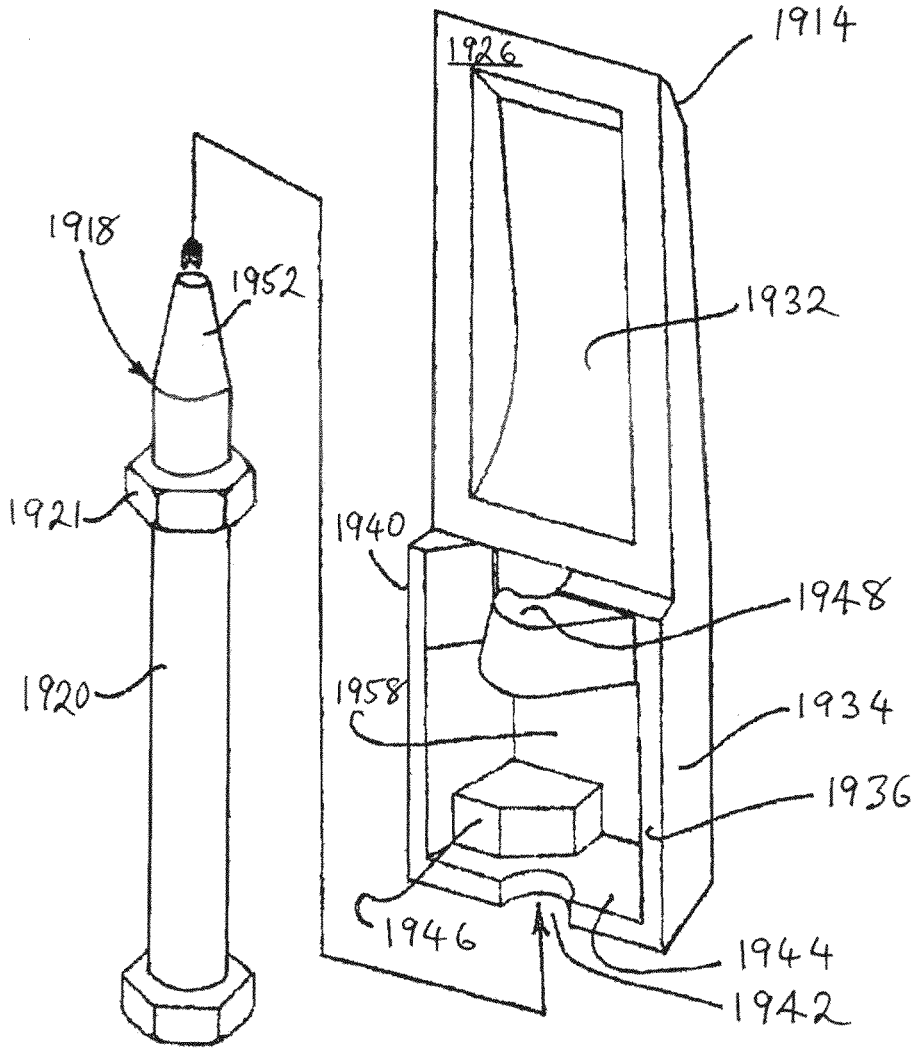
FIG. 3

FIG. 4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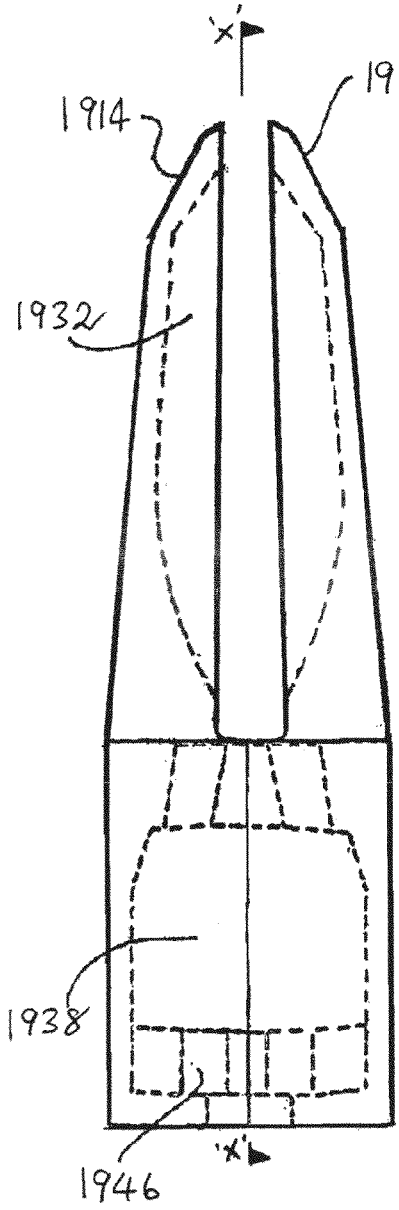
1944
1942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1916
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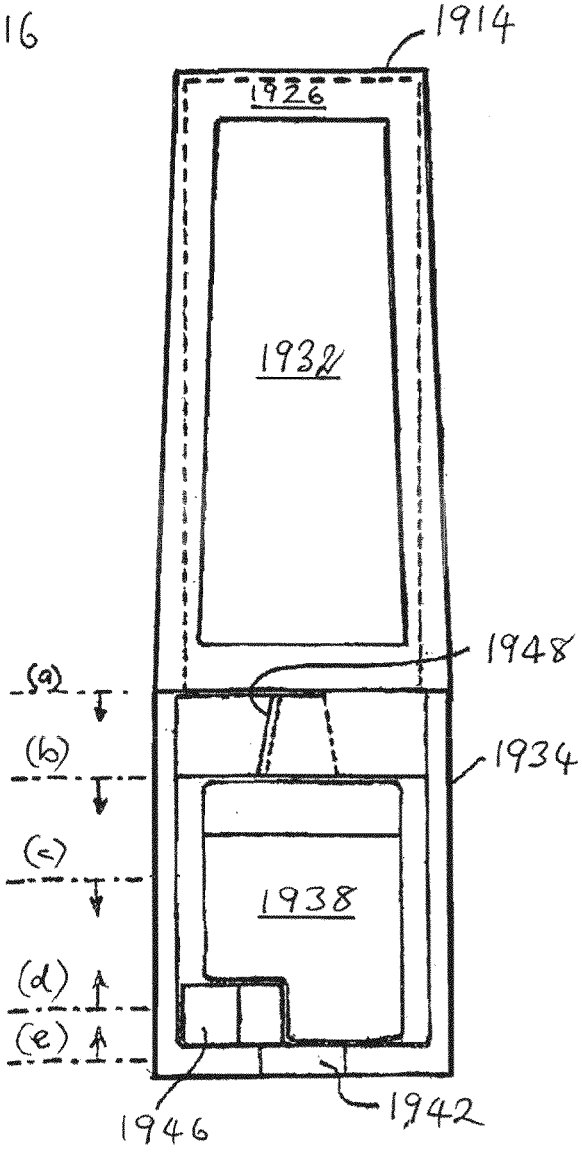
FIG. 5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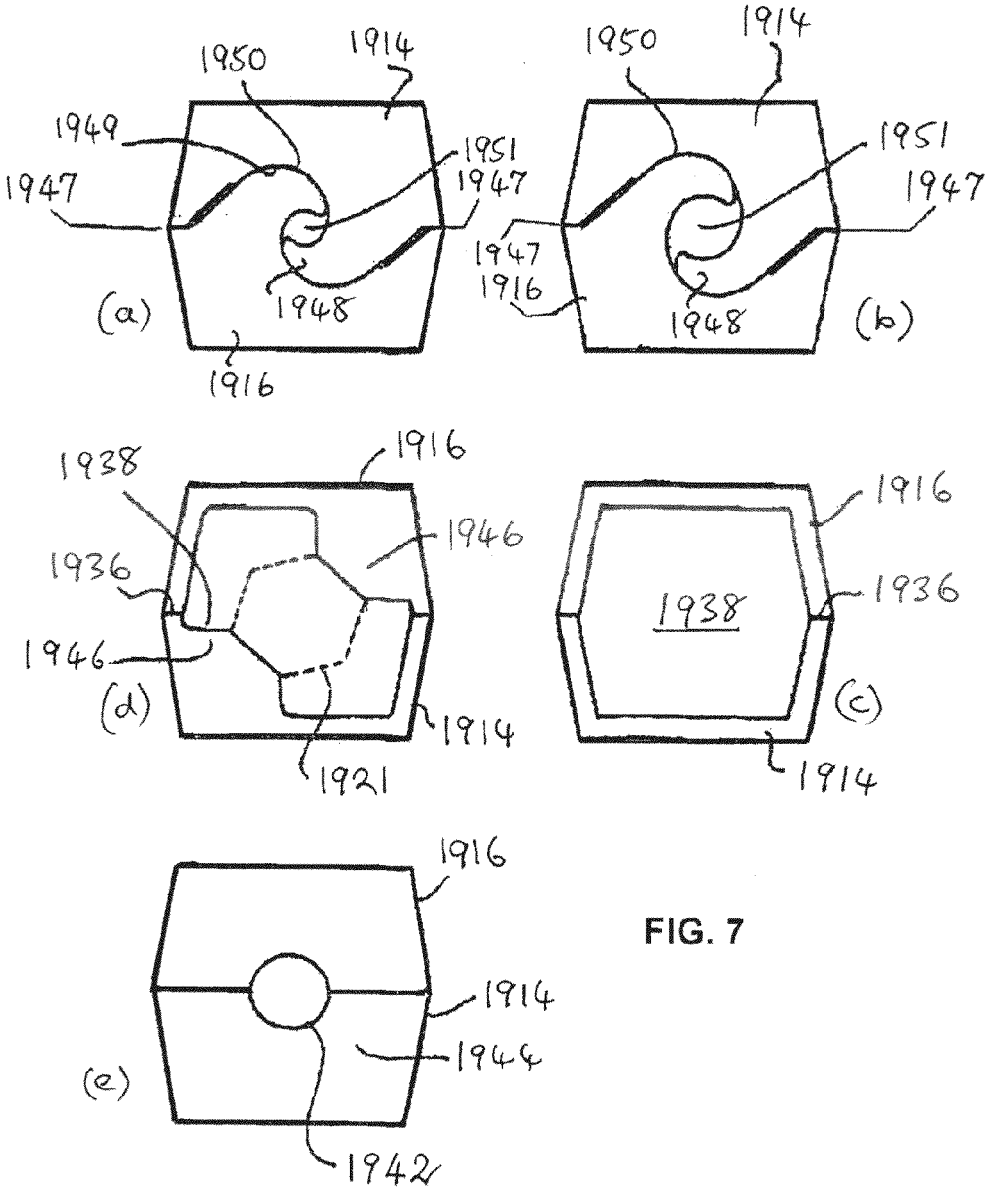
1934
(a)
(b)
(c)
1938
(d)
(e)
1946
1942

FIG. 6


1950
1914
1949
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1947
1947
1948
(a)
1916
1950
1914
1951
1947
1947
1916
1948
(b)
1938
1916
1946
1936
1946
(d)
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1921
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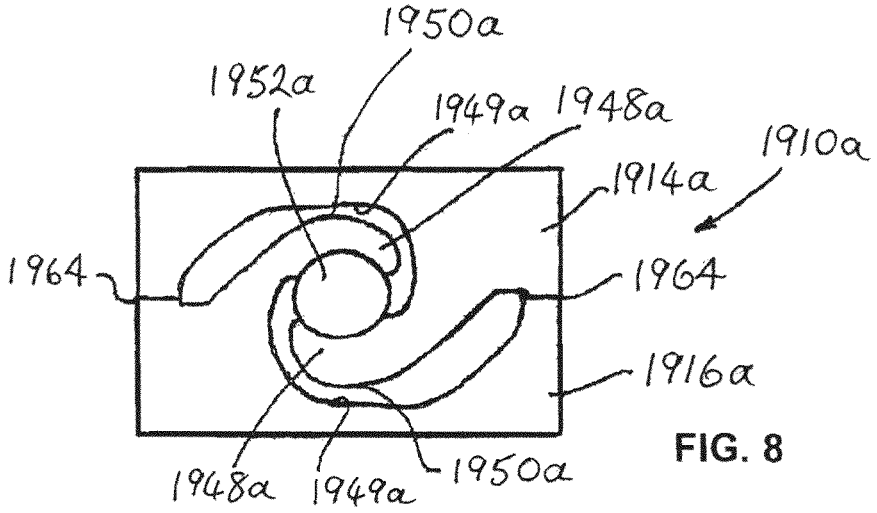
1938
1936
(c)
1914
1916
1914
1944
(e)
1942

FIG. 7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1916a
1948a
1949a
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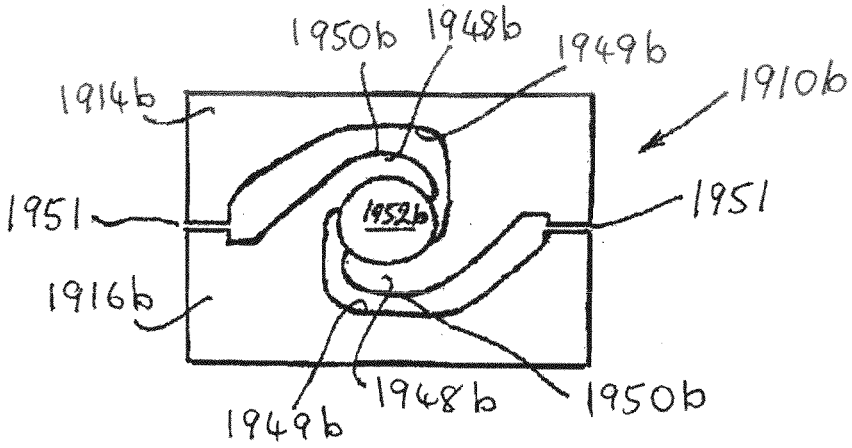
FIG. 8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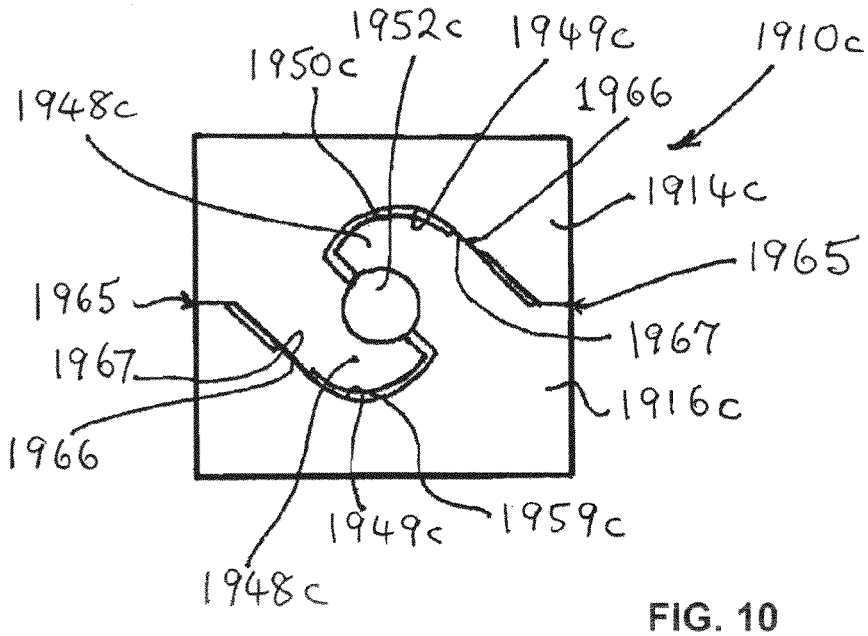
1916b
1952b
1949b
1948b
1950b

FIG. 9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1965
1965
1967
1967
1916c
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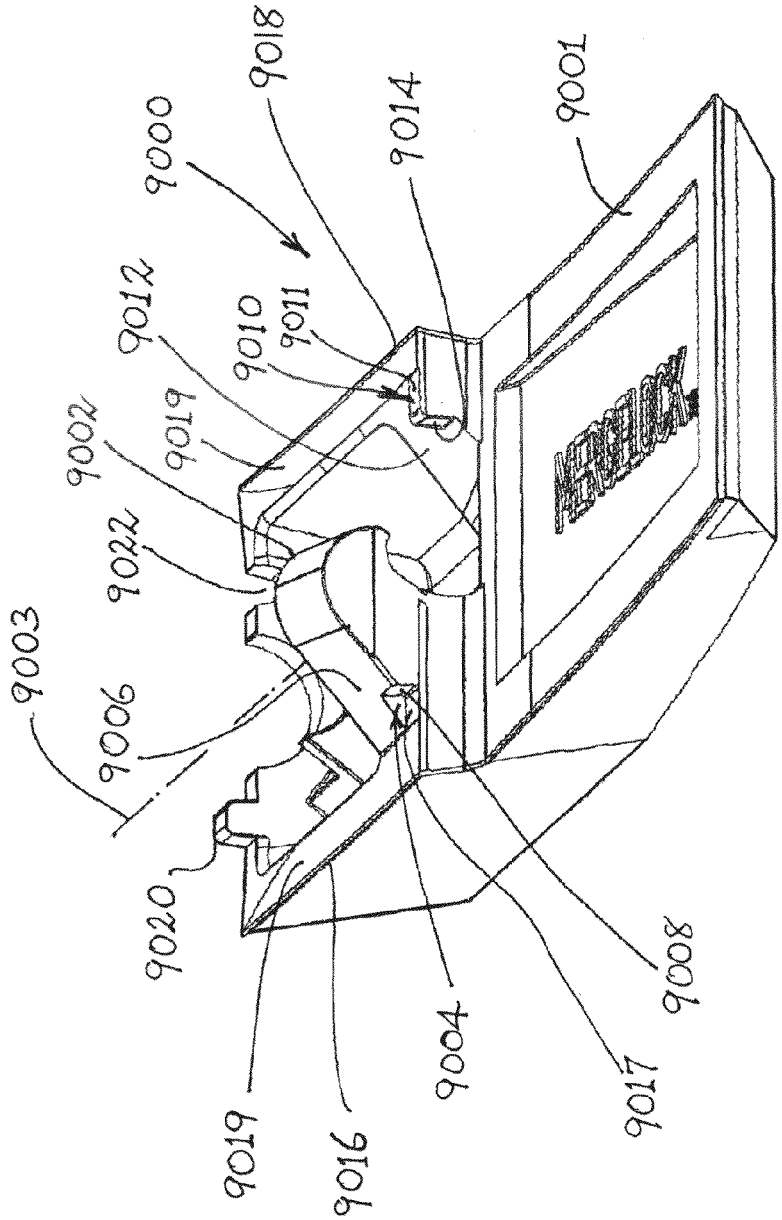
1949c
1959c
1948c

FIG. 10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9004
9017
9008

FIG. 11

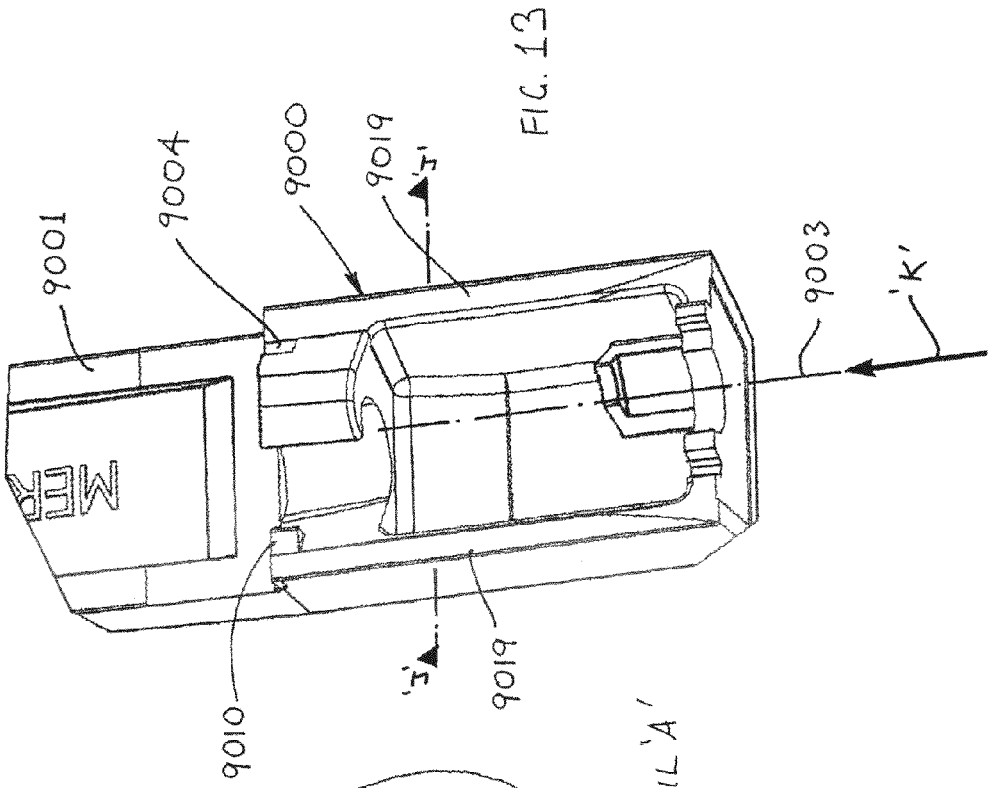


FIG. 13

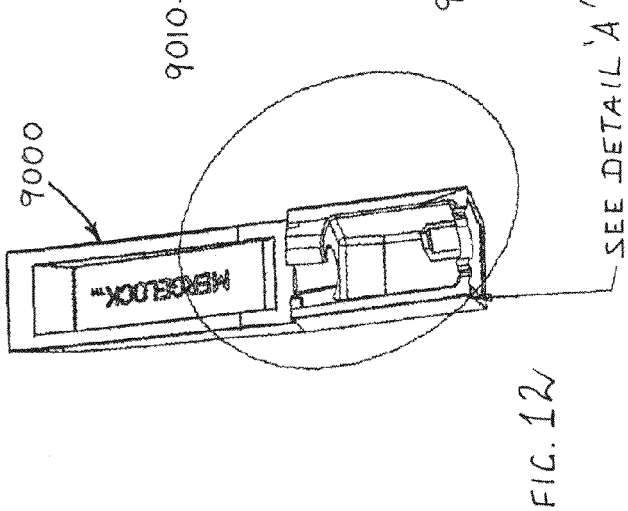


FIG. 12

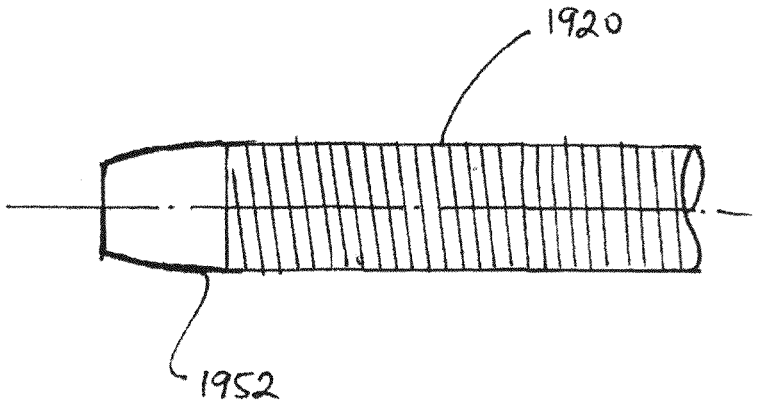


FIG. 14

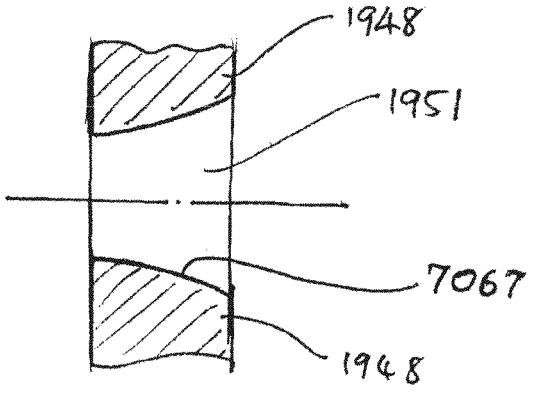


FIG. 15

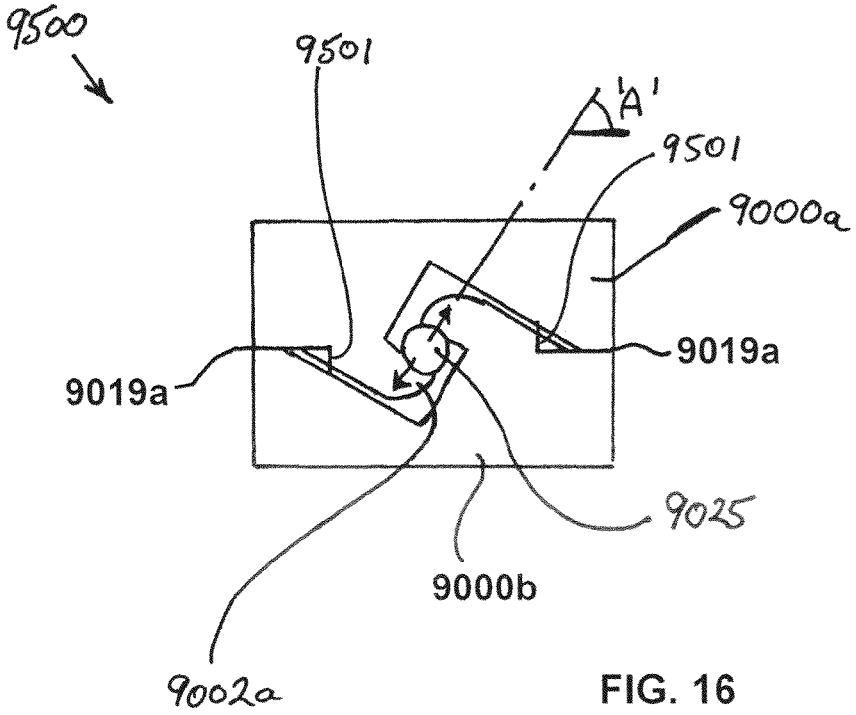


FIG. 16

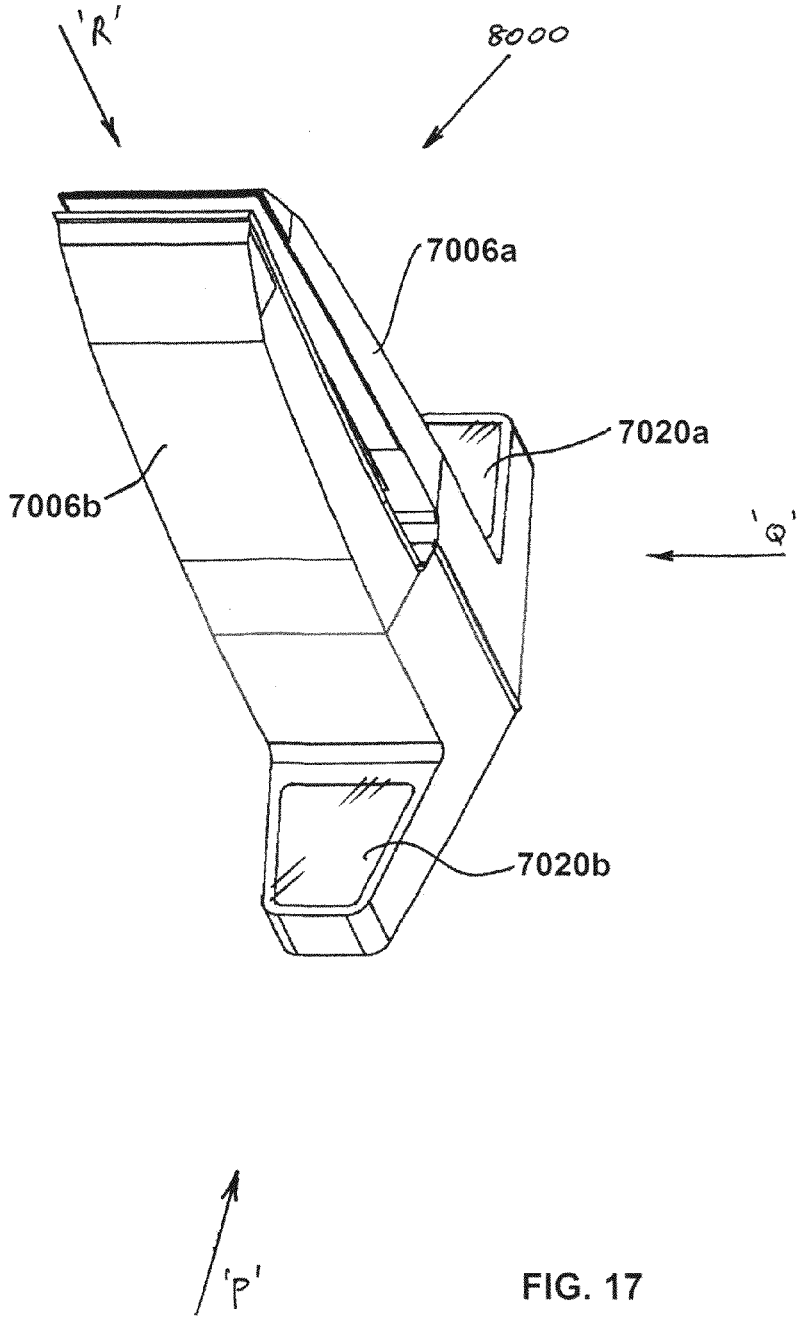


FIG. 17

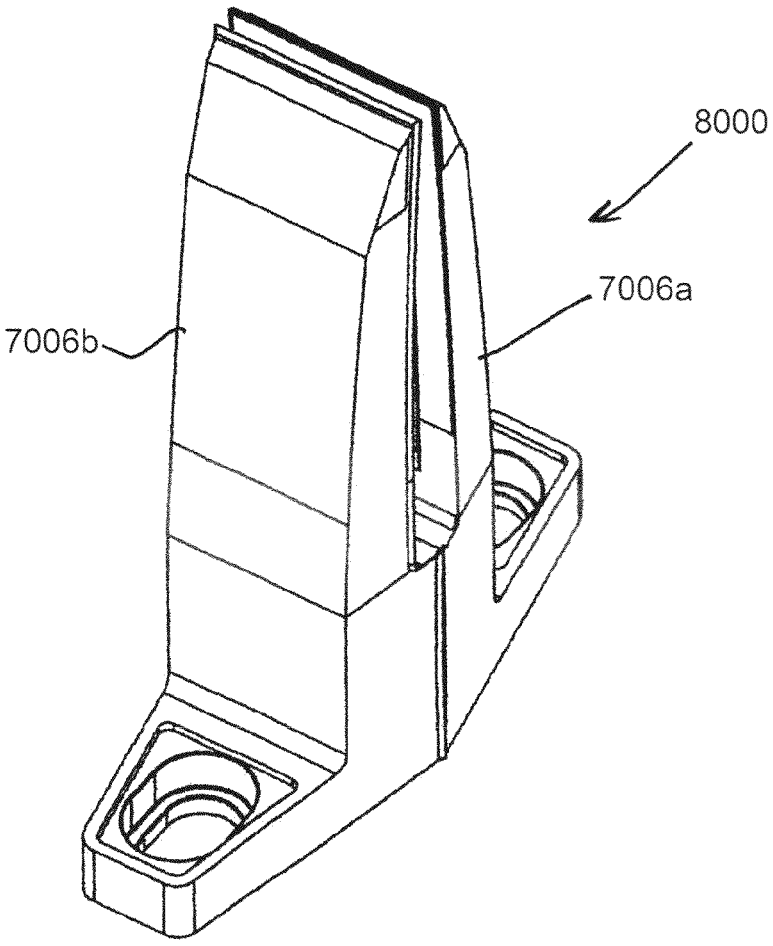
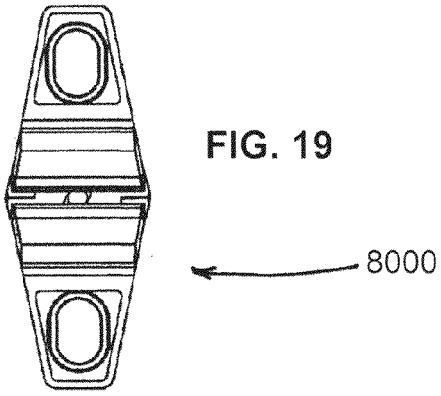


FIG. 18



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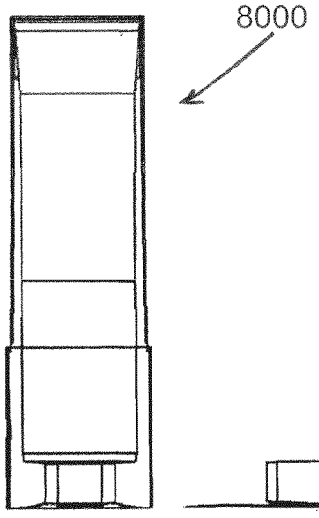


FIG. 20

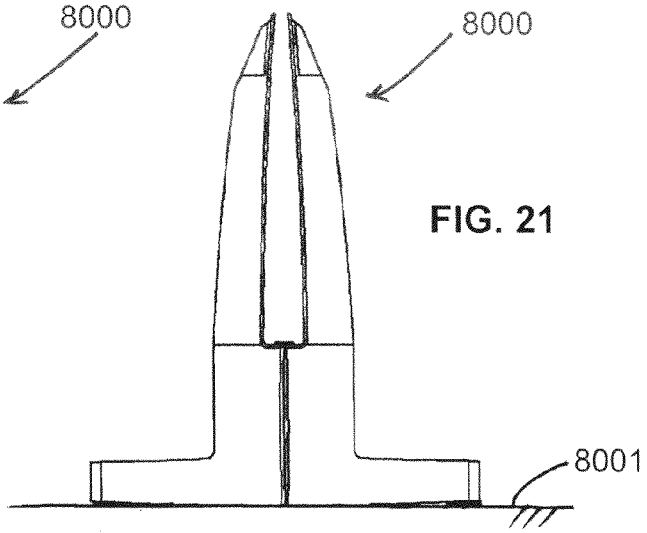
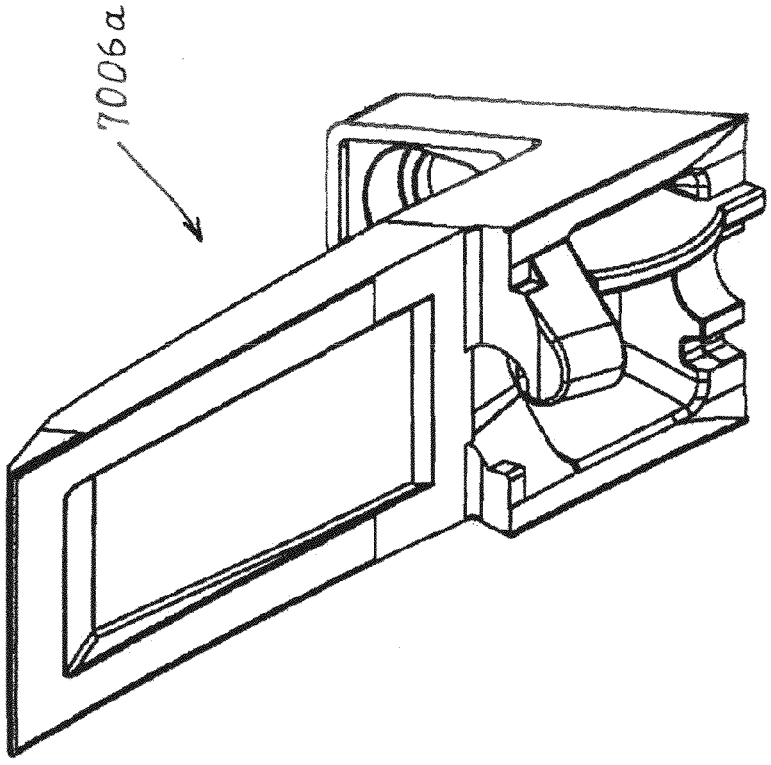
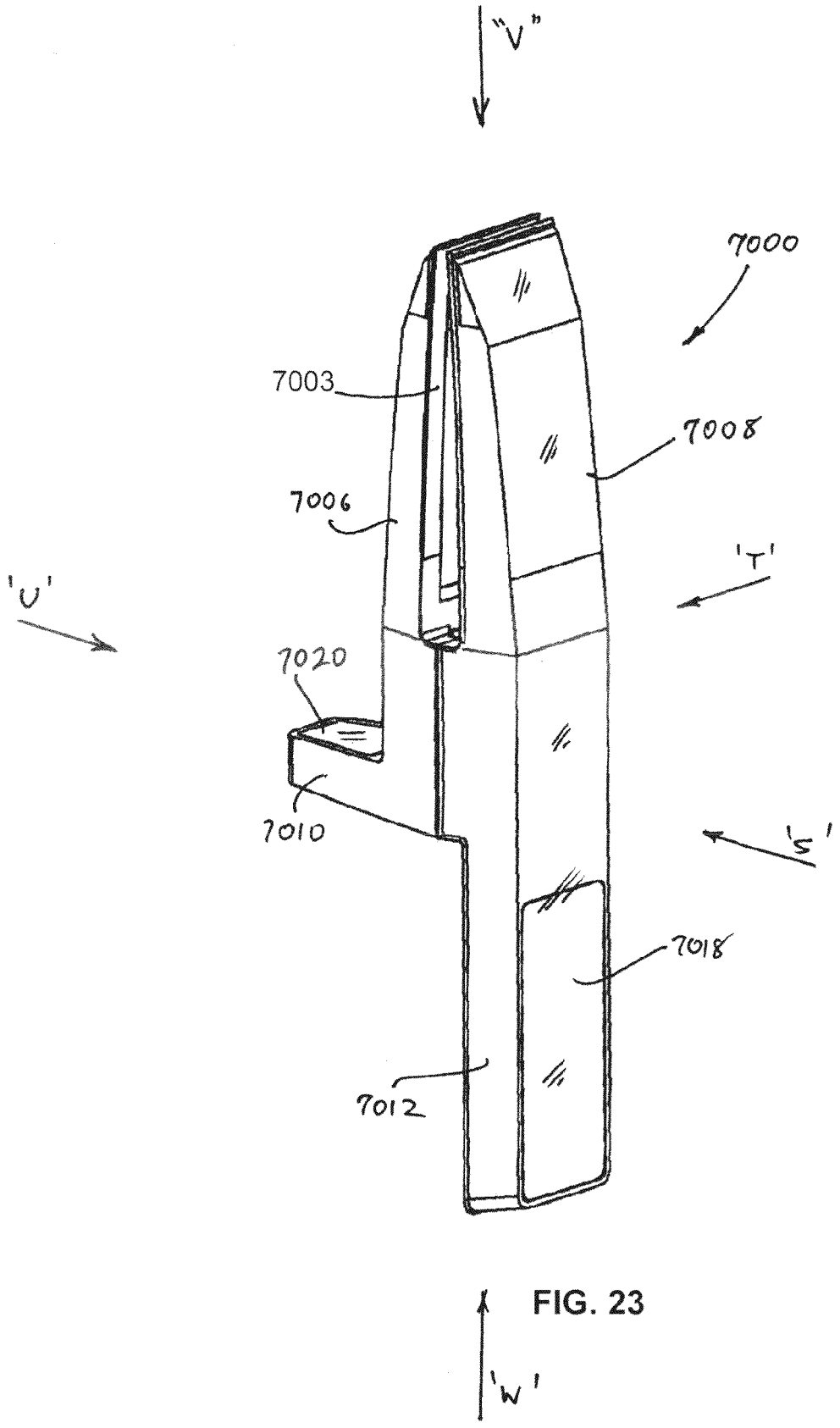


FIG. 21

FIG. 22





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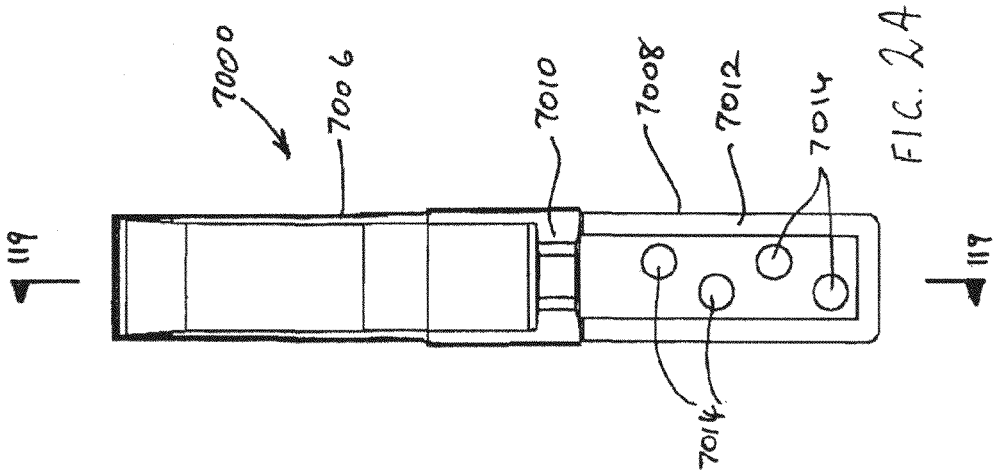


FIG. 24

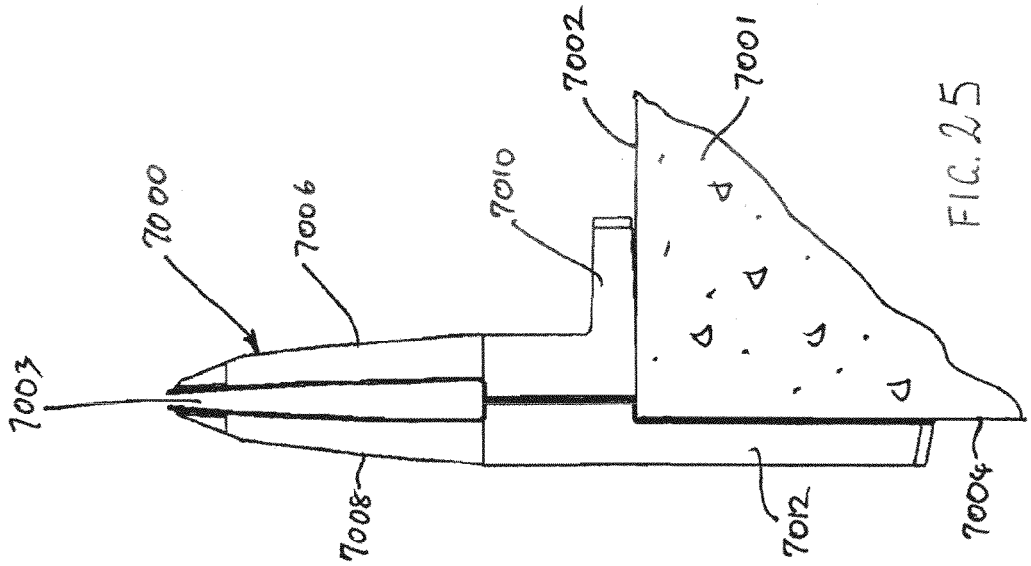


FIG. 25

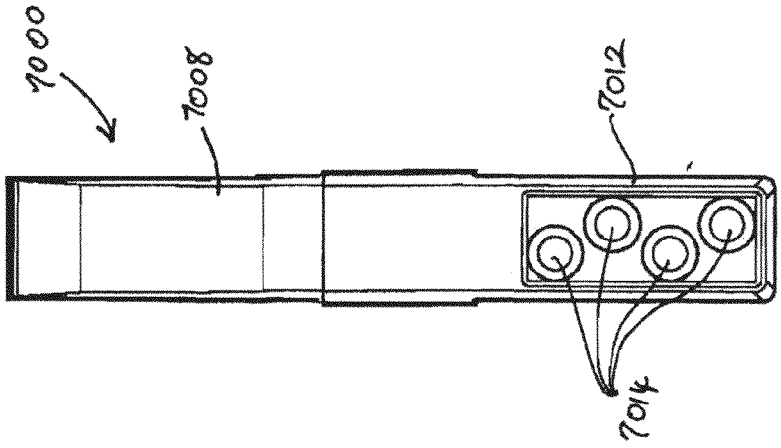


FIG. 26

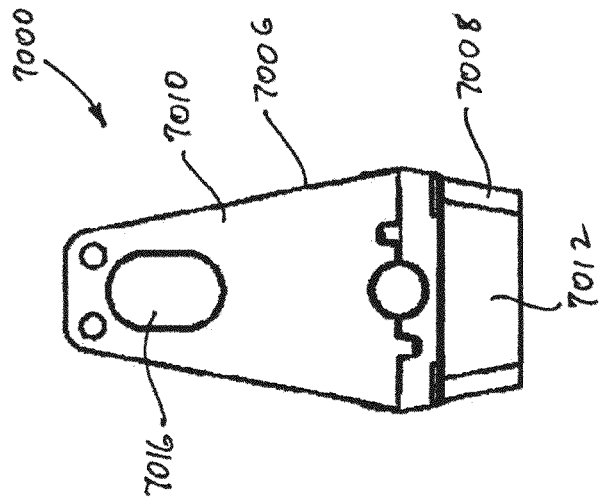


FIG. 27

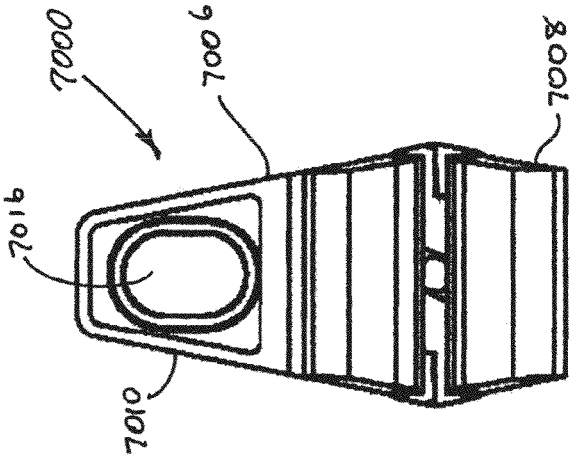
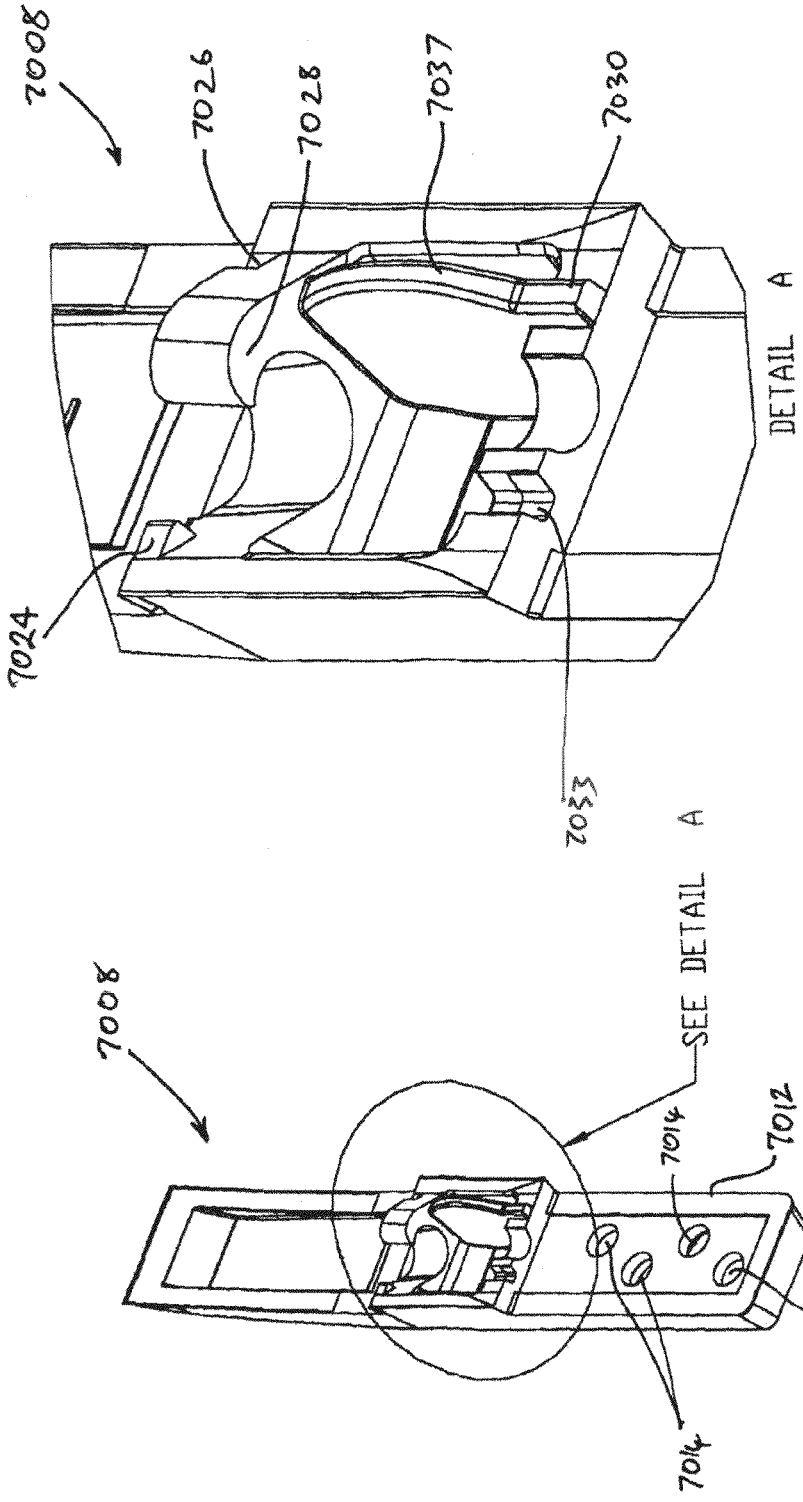


FIG. 28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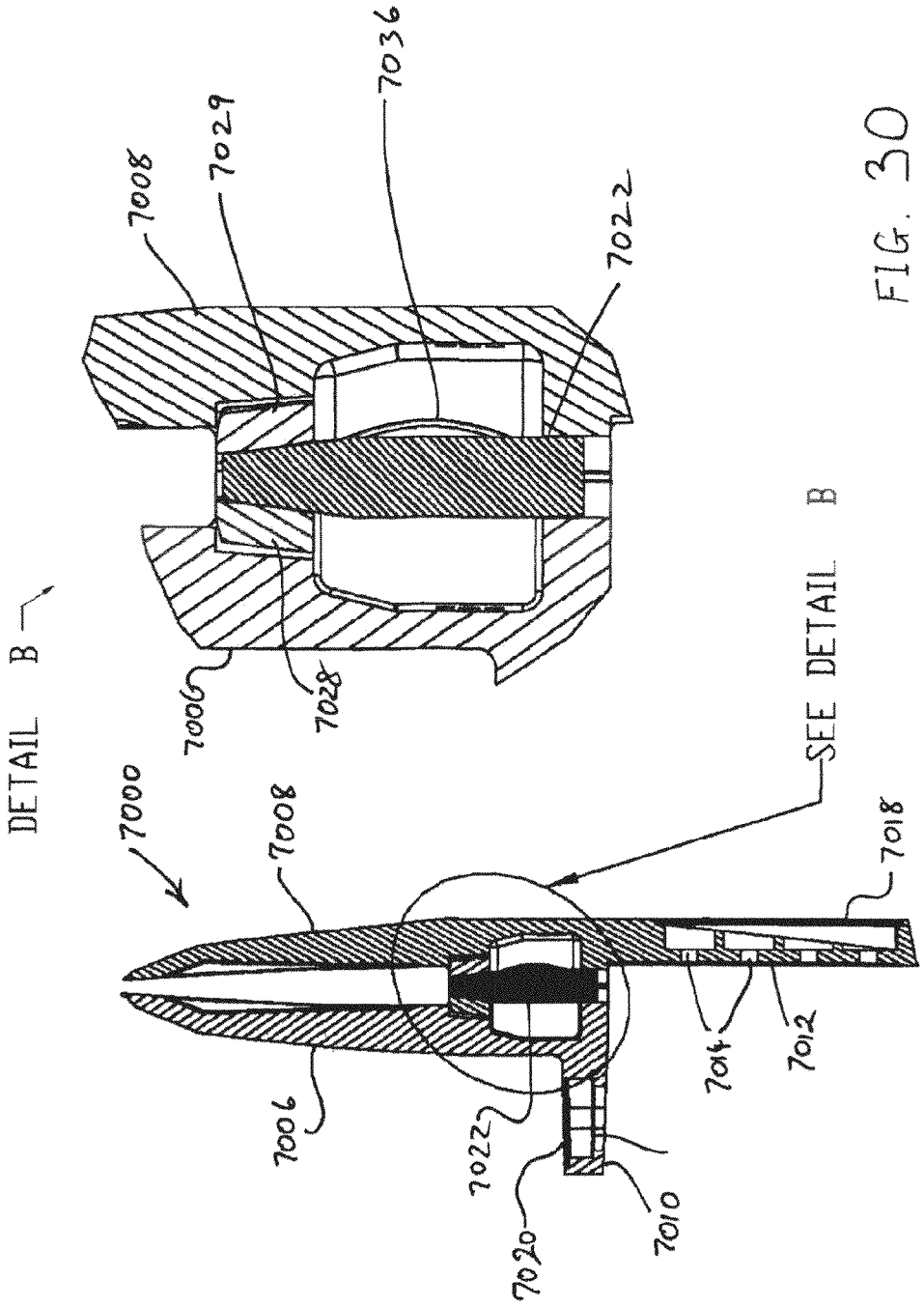
7008
7014
7012
7014
7014

FIG. 29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7010

FIG. 30

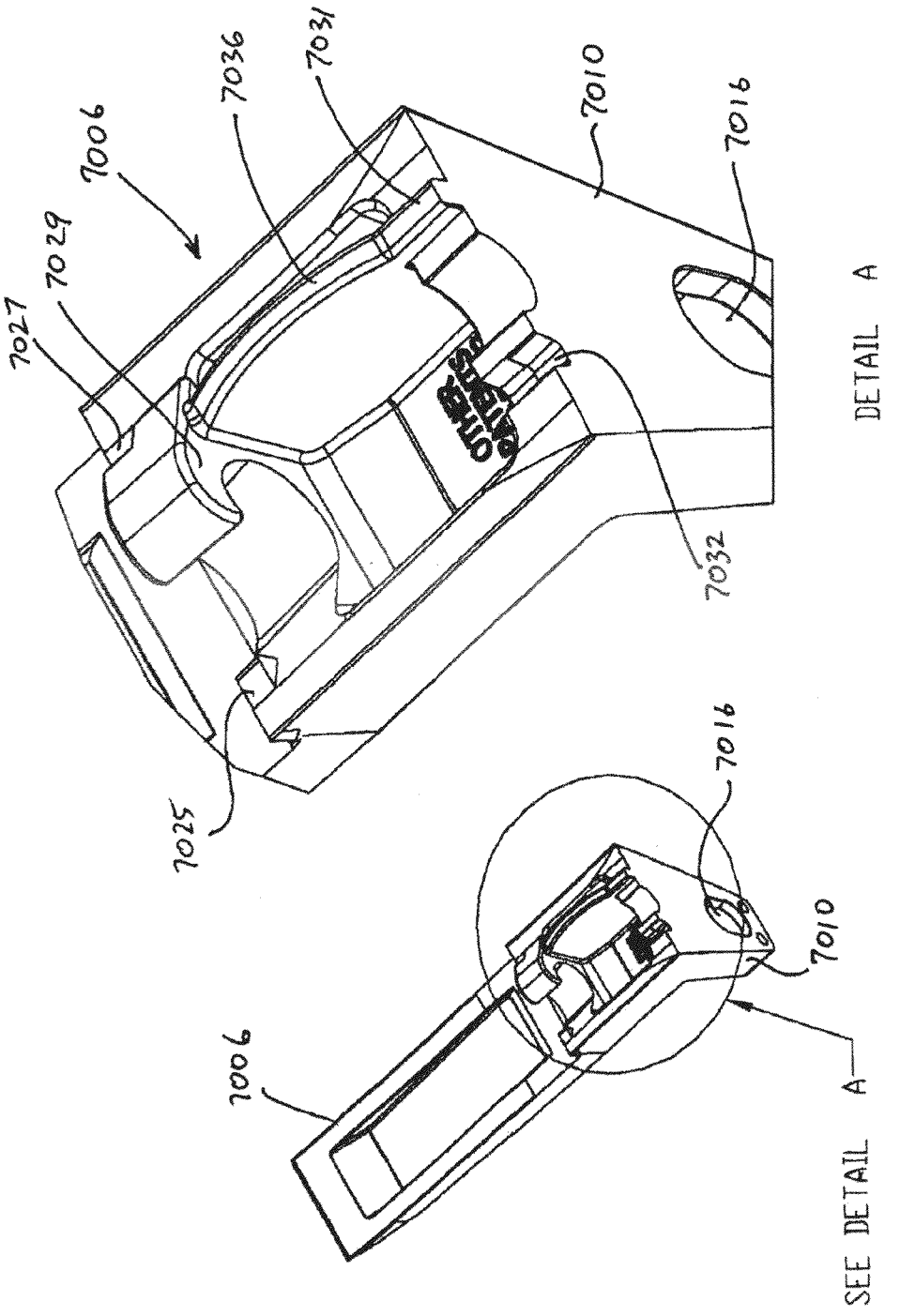
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FIG. 31

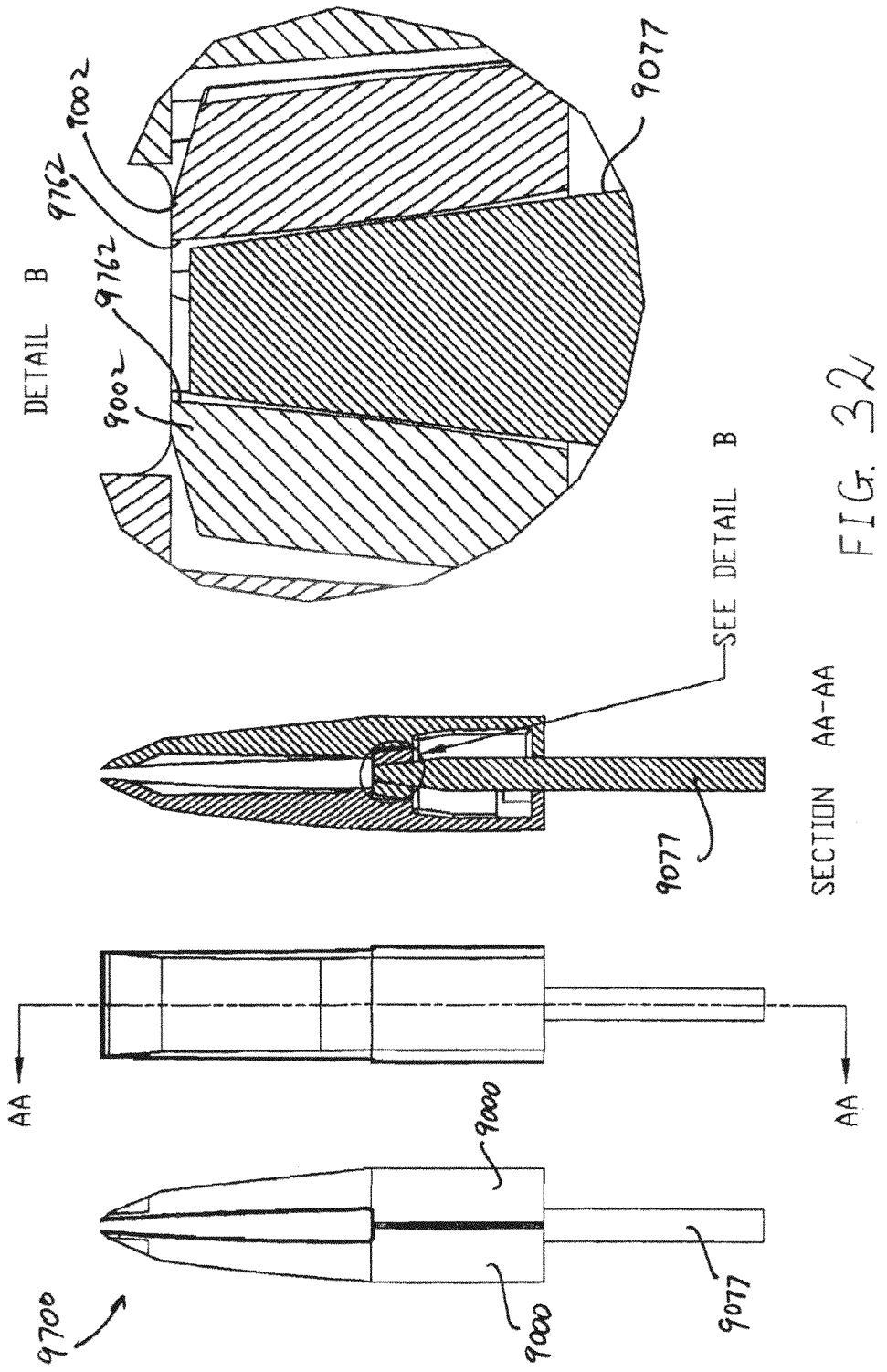
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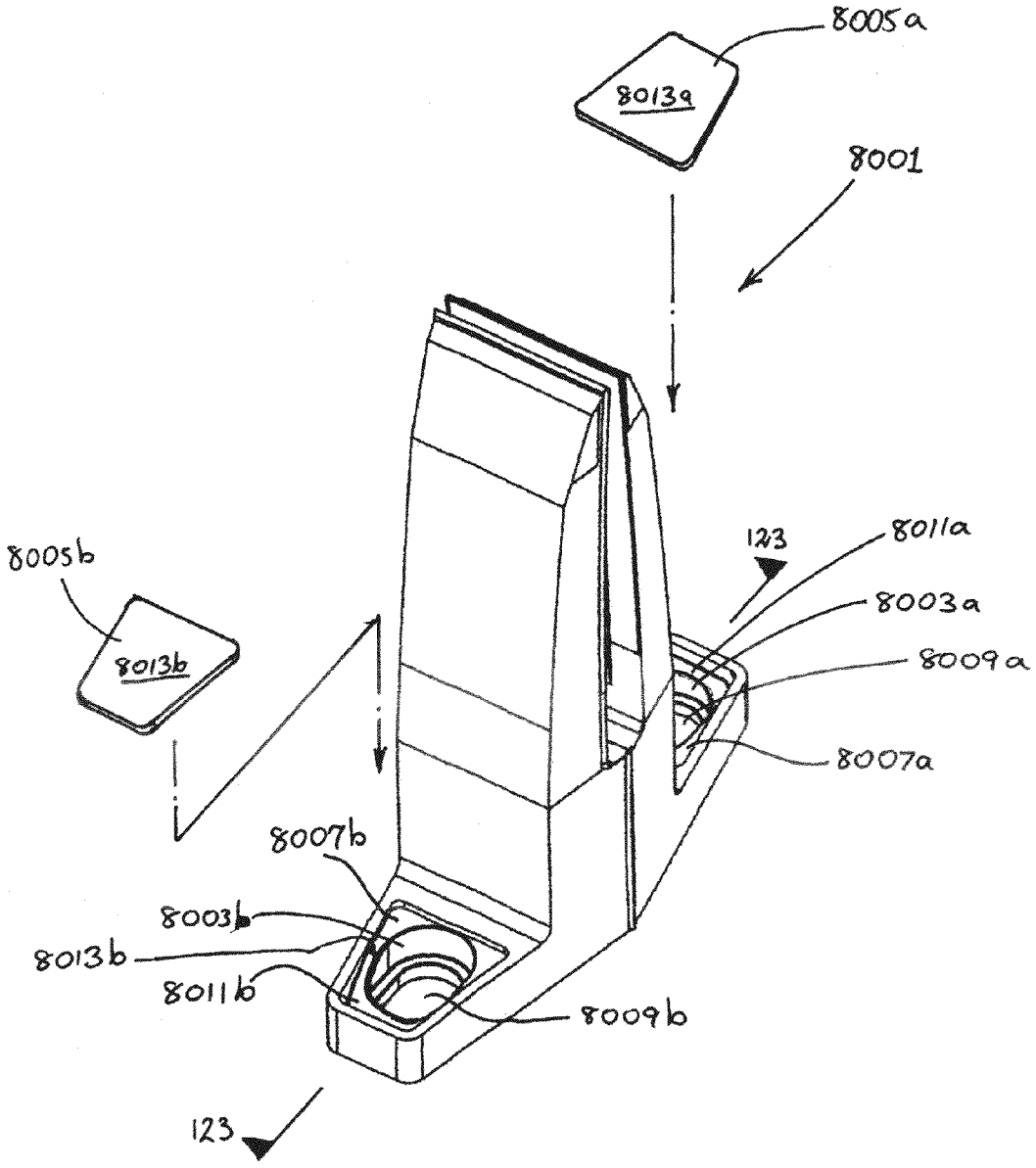
FIG. 32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8009b
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FIG. 33

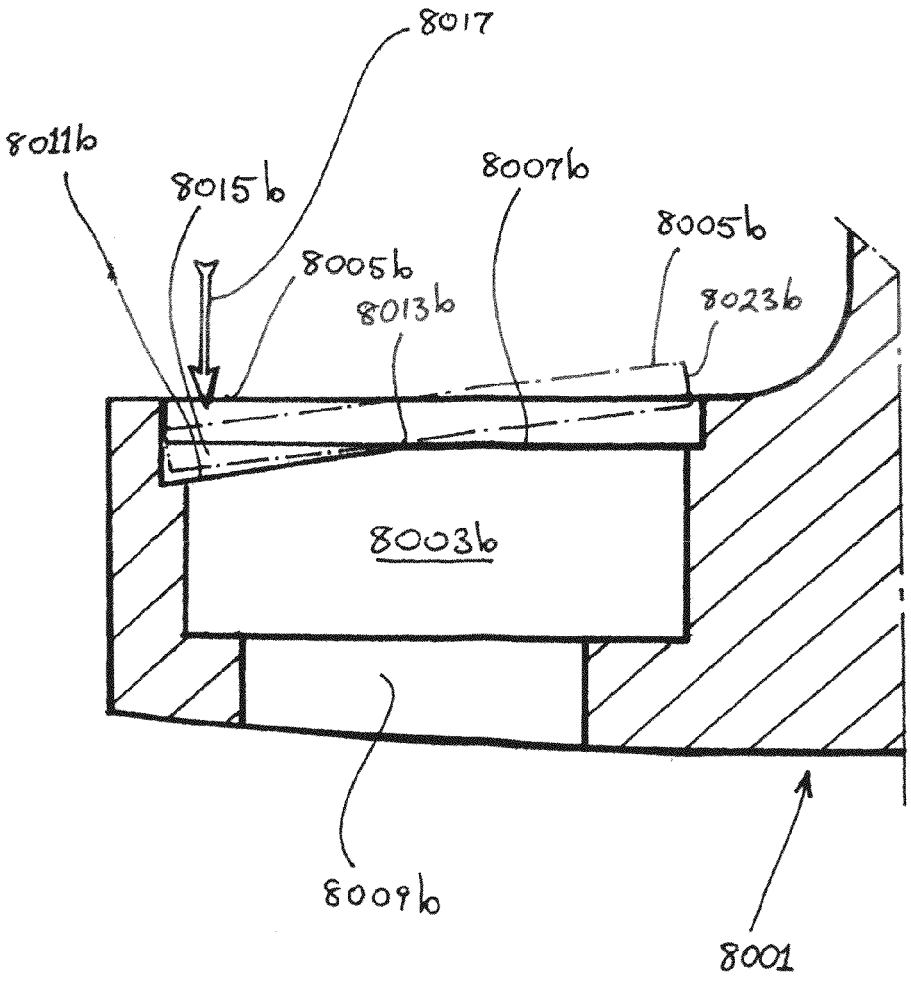
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FIG. 34

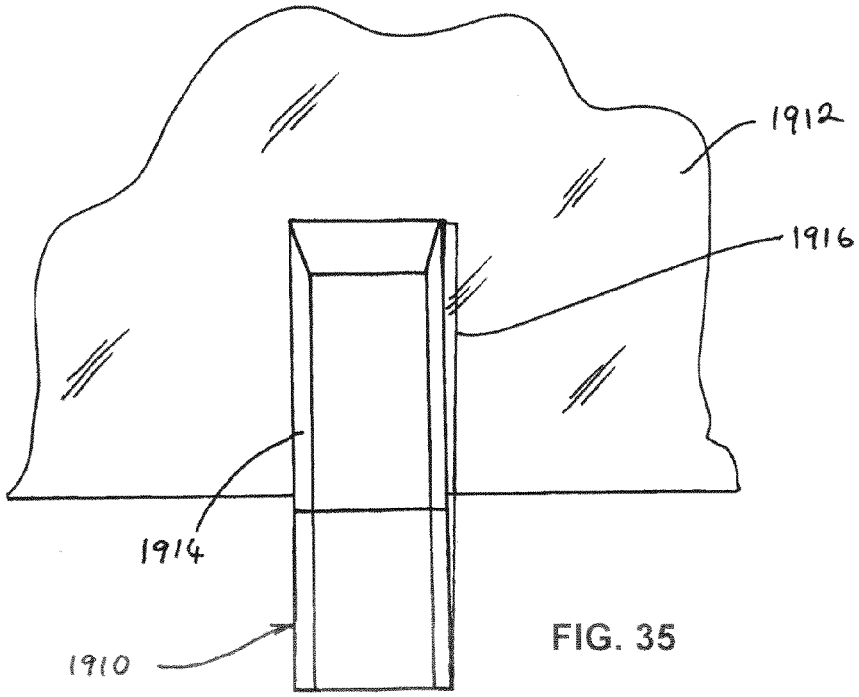


FIG. 35

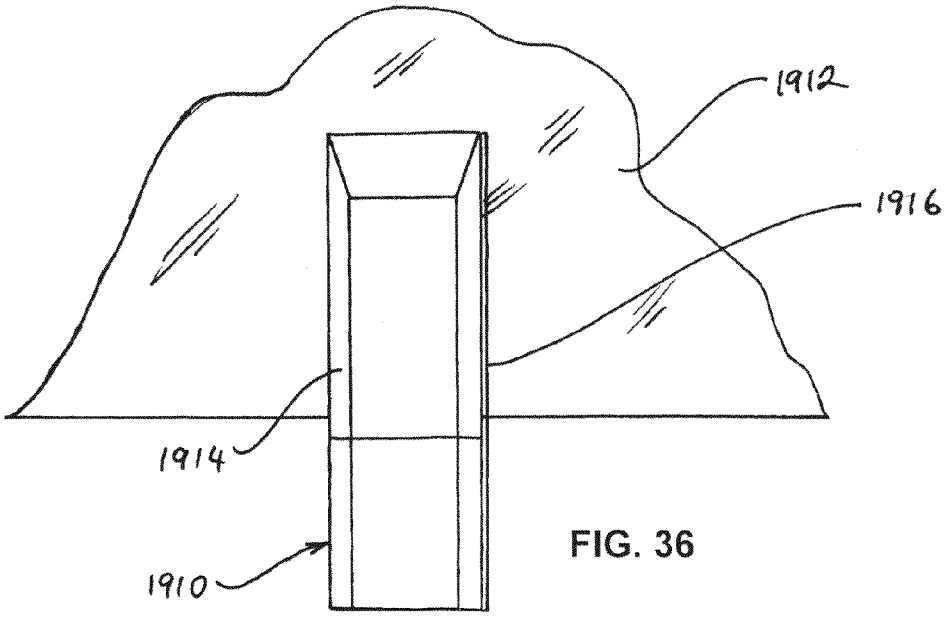
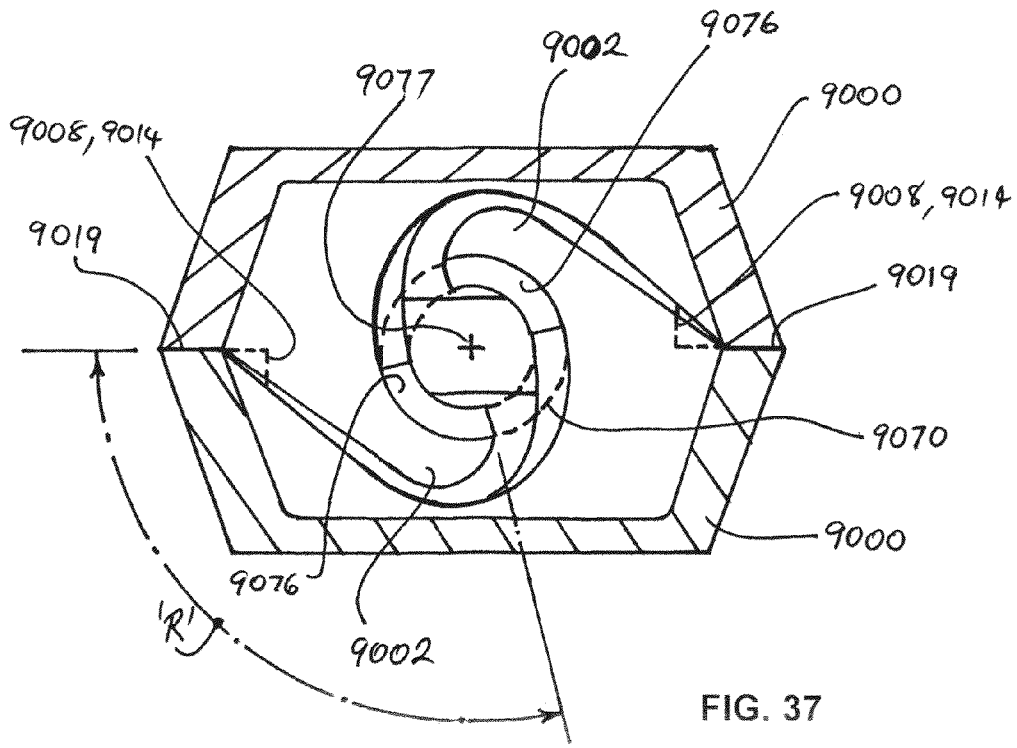


FIG. 36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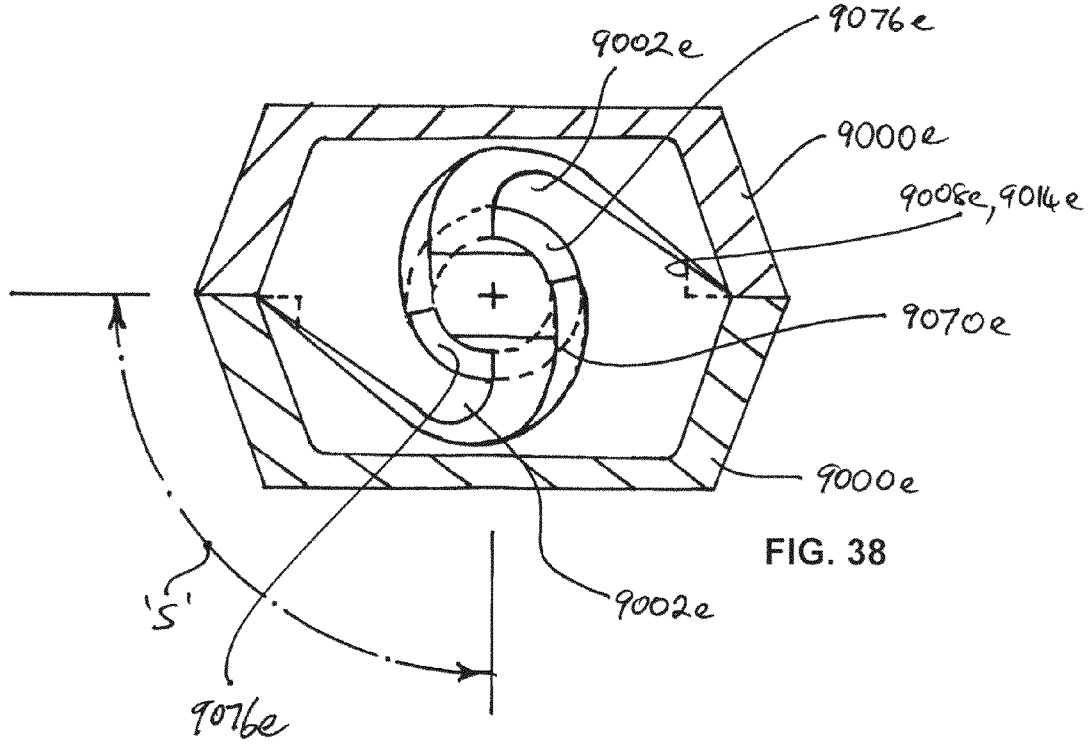
9002

FIG. 37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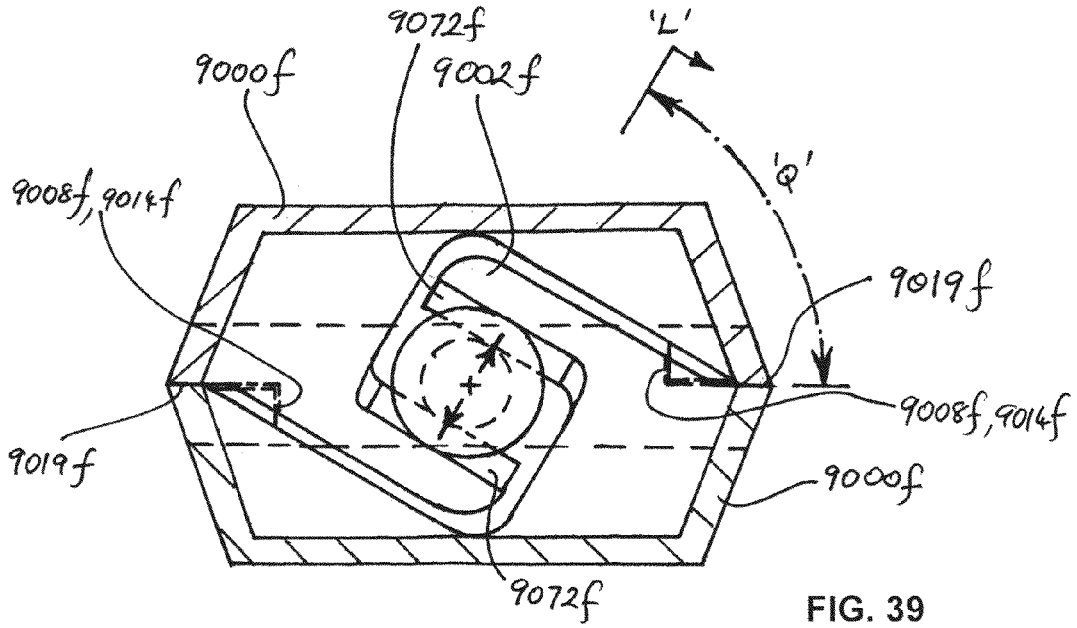
9076e

FIG. 38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'Q'
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9008f, 9014f
9000f
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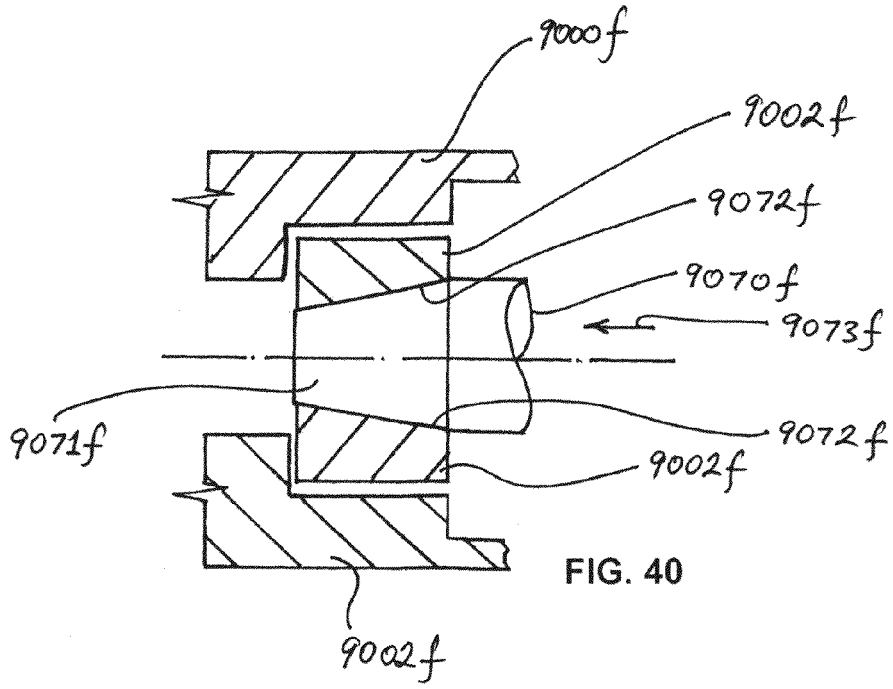
FIG. 39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9070f
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9071f
9072f
9002f
9002f

FIG. 40

CLAMPS FOR PANELS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a U.S. National Phase filing under 35 U.S.C. §371 of PCT/IB2012/001740, which was filed on Sep. 10, 2012, which is herein incorporated in its entirety, which claims priority to Australian Application No.: 2011903654, which was filed on Sep. 8,2011, Australian Application No.: 2011904258, which was filed on Oct 10, 2011, and Australian Application No. 2012903448, which was filed on Aug. 10, 2012, which are all herein incorporated in their entirety.

FIELD OF THE INVENTION

The invention described here relates to improved clamps for panels, with particular reference to clamps for use in fences and barriers.

BACKGROUND

FIG. **1** is a perspective view of a portion of a fence **1** that comprises a plurality of panels **2** arranged end-to-end with small gaps **3** therebetween, each panel being held in a vertical plane by two clamps **4**, with clamps **4** being set into a supporting surface **5**. Fences of this type, typically with panels **2** being made of glass or a transparent plastic (for example those sold under the trade marks Lexan and Perspex), are widely used as security fences for swimming pools, to mark boundaries of eating areas of restaurants and in like applications. They have sometimes been used as balustrades on buildings.

The appearance and the speed and ease of erection of fence **1** are dependent in part on the design of the panel-supporting clamps **4**, as of course is the structural integrity and safety of fence **1**. Clamps applicable to such fences, and to certain other fences also, are described below. These are believed to be useful additions to the choices available to designers, when judged by the combination of appearance, erection ease and speed, and by the safety and integrity they offer.

The clamps disclosed herein can avoid or limit the obtrusive sight of fasteners on the clamps' exteriors. By way of example, a prior art clamp having externally visible fasteners is disclosed by Austin in International Patent Publication No. WO03/091516.

There are further provided clamps that have improved means for holding together their main parts so that they can be assembled in more accurate alignment with each other.

SUMMARY OF THE INVENTION

Throughout this specification, clamps for panels are described that comprise two main parts, each of which has a clamping surface that in use bears directly or via a spacer or gasket against a face of a panel that is clamped. For clarity conciseness and convenience, each such part will be referred to, throughout this specification including in the appended claims, as a "clamp half". It is not intended to imply that such a "clamp half" necessarily constitutes half of a clamp, and indeed all of the clamps described herein include two "clamp halves" and other parts.

In a first invention, there is provided a clamp for panel-shaped members comprising:

a first clamp half comprising a first clamping surface;

a second clamp half comprising a second clamping surface; and

a locating component,

wherein said first and second clamp halves and said locating component in use interlock with each other so that said first clamping surface and said second clamping surface are positioned to press respectively against opposing faces of a panel positioned therebetween,

and further wherein:

said first clamp half has a first surface that faces generally in a direction opposite to the first clamping surface and said second clamp half has a first surface that faces generally in a direction opposite to the second clamping surface so that urging apart of said first surfaces by the locating component urges the clamping surfaces of the clamp halves towards each other;

the locating component is capable of movement through a range of positions relative to said first surfaces until a final position is reached in which position the locating component lies between and urges apart the first surfaces so as to urge said first and second clamping surfaces against opposing faces of the panel therebetween;

the first clamp half comprises a first guide surface and the second clamp half comprises a second guide surface;

the said first surfaces of the first and second clamp halves are so oriented relative to the locating component as to urge together the first and second guide surfaces during at least a part of said movement of the locating component, whereby to at least partially guide the relative movement of the first and second clamping means during such movement.

Further according to the first invention, there is provided a clamp for panel-shaped members comprising:

a first clamp half having a first clamping surface;

a second clamp half having a second clamping surface; and

an elongate locating component having a tapered portion,

wherein:

the first clamp half comprises a first formation and the second clamp half comprises a second formation;

the locating component is movable lengthwise during assembly of the clamp so that the tapered portion moves between the first and second components whereby to urge them portions of them apart so that the first and second clamping surfaces are urged towards each other so as to clamp a panel between the first and second clamping surfaces;

and further wherein:

the first clamp half comprises a first guide surface and the second clamp half comprises a second guide surface which guide surfaces when held in abutment with each other during movement of the first and second clamping surfaces towards each other prevent at least in their vicinity relative movement of the first and second clamp halves in a plane perpendicular to the movements of both the clamping surfaces and the locating component; and

the urging apart of the portions of the first and second formations moves the guide surfaces into abutment and subsequently holds the guide surfaces in abutment.

In a second invention, there is provided a clamp for clamping panel-shaped members, comprising:

a first clamp half having a first clamping surface;

a second clamp half having a second clamping surface;

means for securing the first and second clamp halves together with a panel-shaped member clamped between the first clamp surface and the second clamping surface,

and wherein:

the first clamp half comprises a flange with a first opening for a fastener therein said first opening oriented so that a fastener extending through the first opening can secure the flange to a first support surface;

the second clamp half comprises a portion with at least one second opening for a fastener therein said second opening oriented approximately perpendicular to the first opening, so that a fastener extending through the or a said second opening can secure the portion to a second support surface that is approximately perpendicular to the first support surface.

It is preferred that the said portion have a face oriented to in use abut said second surface.

It is further preferred that a panel-shaped member clamped in the clamp lie parallel to and be at least approximately co-planar with the face oriented to in use abut said second surface.

A clamp according to this second invention may be adapted to be mounted on a right-angled corner of a structure, such as a concrete slab forming a balcony or the like.

It is particularly preferred to provide a clamp according to this second invention is a clamp that accords with the first invention mentioned above, in respect of the way in which the first and second clamp halves are connected to each other. Such an embodiment of this second invention is disclosed herein by reference to FIGS. **23** to **31**.

There is further provided herein a third invention applicable to clamps for panel-shaped members by means of which third invention a fastener used either to hold parts of a clamp together or to secure the clamp to a structure can be concealed by a cover plate that is readily removable when required.

This third invention provides, in a clamp for panel-shaped members, the improvement wherein:

a portion of a fastener holding together parts of the clamp or securing the clamp to a structure is received within a recess;

the recess is in use of the clamp covered by a cover plate that is received close-fittingly in the recess;

the recess contains one or more lands against which one or more lands the cover plate abuts when in its installed position and to which the cover plate can be adhered so as to secure the cover plate within the recess;

the lands are so proportioned and so positioned within the recess that a first portion of the cover plate can be moved inward into the recess by application to the cover plate of a force directed outside a periphery of the one or more lands whereby a second portion of the cover plate emerges from the recess.

A preferred embodiment of the second invention is disclosed herein that also embodies this third invention.

Everywhere in this specification, the word "comprise" and derivatives thereof such as "comprising" and "comprises" when used in relation to a set of elements integers features or steps are to be taken to indicate that the elements integers features or steps are present, but are not to be taken to preclude the possibility of other elements integers features or steps being present also.

No reference in this specification to a particular patent or other publication or to prior art is to be interpreted as conceding that the contents of that patent or publication, or that piece of prior art are a part of the common general knowledge in any jurisdiction.

Preferred embodiments of the inventions will be further described in the following detailed description, by reference to the attached Figures, of which:

FIG. **1** is a perspective view of a portion of a fence having clamps of a type disclosed herein;

FIG. **2** is a side view of a prior art clamp, supporting and clamping a glass panel;

FIG. **3** is a front view of the clamp shown in FIG. **2**;

FIG. **4** is a perspective view of one of two identical clamp halves of the clamp shown in FIG. **2** together with a nut-and-bolt assembly of that clamp;

FIG. **5** is a side view of the clamp shown in FIG. **2**, showing hidden lines;

FIG. **6** is a front view of one of two identical clamp halves of the clamp shown in FIG. **2** and is aligned vertically with FIG. **5**;

FIG. **7** comprises five cross-sections marked (*a*)-(*e*) of the clamp half shown in FIG. **6**, the sections being taken at the stations marked (*a*), (*b*), (*c*), (*d*) and (*e*) respectively extending between FIGS. **5** and **6**;

FIG. **8** is a cross section through a modified version of the clamp shown in FIG. **2**, the section being equivalent to that of FIG. **7**(*b*);

FIG. **9** is a cross section (not to scale) through a further modified version of the clamp shown in FIG. **2**, the section being equivalent to that of FIG. **7**(*b*);

FIG. **10** is a cross section through a modified version of the clamp shown in FIG. **2**, the section being equivalent to that of FIG. **7**(*b*);

FIG. **11** is a perspective view of a clamp half according to the invention;

FIG. **12** is a further perspective view of the clamp half shown in FIG. **11**;

FIG. **13** is a detail ("A") of FIG. **12**;

FIG. **14** is a side view of portion of a component shown in FIG. **4**, modified according the present invention;

FIG. **15** is a partial cross-sectional view through the prior art clamp as shown in FIG. **5** taken at station "X-X" and between stations (*a*) and (*b*) with the clamp parts shown being modified according to the present invention;

FIG. **16** is a simplified and schematized cross-section of a clamp made using two clamp halves of the type shown in FIG. **11**;

FIG. **17** is a perspective view of a deck-mountable clamp made according to the invention;

FIG. **18** is a perspective view of the clamp of FIG. **17** with some parts removed;

FIG. **19** is a view of the clamp of FIG. **17** looking in the direction of arrow "R";

FIG. **20** is a view of the clamp shown in FIG. **17** looking in the direction of arrow "P";

FIG. **21** is a view of the clamp shown in FIG. **17** looking in the direction of arrow "Q", the clamp being mounted to a deck;

FIG. **22** is a perspective view of one clamp half of the clamp shown in FIG. **17**;

FIG. **23** is a perspective view of a further clamp according to the invention;

FIG. **24** is a view of the clamp of FIG. **23** seen looking in the direction of arrow "U";

FIG. **25** is a view of the clamp of FIG. **23** seen looking in the direction of arrow "T", the clamp being shown mounted to a slab edge;

FIG. **26** is a view of the clamp of FIG. **23** seen looking in the direction of arrow "S" with a cover plate removed;

FIG. **27** is a view of the clamp of FIG. **23** seen looking in the direction of arrow "W";

FIG. **28** is a view of the clamp of FIG. **23** seen looking in the direction of arrow "V", and with a cover plate removed;

FIG. **29** is a perspective view of one clamp part of the clamp shown in FIG. **23** with a portion shown as an enlarged detail;

FIG. **30** is a sectional view of the clamp as shown in FIG. **24**, the section being taken at the station "**119-119**";

FIG. **31** is a perspective view of another clamp part of the clamp shown in FIG. **23** with a portion shown as an enlarged detail;

FIG. **32** comprises two views of a clamp made with two clamp halves of the type shown in FIG. **11**, and a section of that clamp with an enlarged detail of that section;

FIG. **33** is an exploded perspective view of a still further clamp according to the invention;

FIG. **34** is a partial cross-sectional view of the clamp shown in FIG. **33**, the section being taken at station "**123-123**" of FIG. **33**;

FIG. **35** is an elevation of a clamp secured to a glass panel, looking in a direction normal to the panel, with one clamp half in angular misalignment relative to the other clamp half;

FIG. **36** is an elevation of a clamp secured to a glass panel, looking in a direction normal to the panel, with one clamp half in lateral misalignment relative to the other clamp half;

FIG. **37** is a cross-section of two of the clamp halves of the type shown in FIG. **13**, with some hidden lines omitted, in the relative positions they would occupy in an assembled clamp, the cross-section of each clamp half being taken at station "J-J" and looking in the direction of arrow "K";

FIG. **38** is an identical view to FIG. **37**, of two assembled clamp halves, with one difference namely that the two clamp halves shown are modified versions of those shown in FIG. **13**;

FIG. **39** is an identical view to FIG. **37**, of two assembled clamp halves, with one difference namely that the two clamp halves shown are modified versions of those shown in FIG. **13**;

FIG. **40** is a partial cross-sectional view of the assembly of two clamp halves shown in FIG. **39**, the cross-section being taken at station "L-L".

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Clamps will be described below that are suitable for use as the clamps **4** in fence **1**, using glass, transparent plastics or other sheet-type materials for the panels **2**. Purely for convenience, glass panels only will be discussed, but this is not intended to imply any limitation on the panel materials to which any of the clamps may be applied. An important class of extra but related application for at least some of the clamps to be described is to the securing of hand- and other rails to panels of glass and other materials of balustrades and the like.

The approach taken is to firstly describe a prior art clamp **1910** and then describe an improvement to that type of clamp according to the present invention.

There will first be described a clamp **1910** that uses the principle of two clamp halves (between which a panel may be clamped) that are held in relative positions for clamping by means of a further component that interlocks with both parts.

FIGS. **2** and **3** show clamp **1910** assembled and supporting a glass panel **1912**. Clamp **1910** has two identical clamp halves **1914** and **1916**, and these are held together (i.e. to interlock) in use of clamp **1910** by a nut and bolt assembly **1918** of which only bolt **1920** is visible. Bolt **1920** may be used to secure clamp **1920** to a structure or to a suitable ground anchor (not shown), or its lower part (shown protruding in FIGS. **2** and **3**) may itself have an anchoring function if for example clamp **1920** is grouted into a hole (not shown) in a ground mass (not shown) or the like.

Panel **1912** is held between elastic pads **1922** and **1924** that lie against opposing faces of panel **1912** and against clamping faces **1926** and **1928** of clamp halves **1914** and **1916** respectively. Below panel **1912** is an elastic pad **1930**.

FIG. **94** shows clamp half **1914**. A cavity **1932** is formed in an upper portion of clamp half **1914** to reduce the clamp weight and the quantity of metal required to make it, although cavity **1932** is optional. (Clamp halves **1914** and **1916** may be made by casting, possibly investment casting, in stainless steel or other suitable material, although this is not to preclude the possibility of other manufacturing methods being used).

A lower portion **1940** of clamp half **1914** has a face **1936** that on assembly of clamp **1910** faces the corresponding face of identical clamp half **1916**. A cavity **1938** is defined within lower portion **1940**. An approximately semicircular cutaway **1942** is defined in a bottom wall **1944** of lower portion **1940**.

Within cavity **1938** there is a formation **1946** whose function when clamp **1910** is assembled is to prevent rotation of nut **1921** of assembly **1918**. At the top of cavity **1938** a formation **1948** extends outward beyond face **1936**. Seen from above, formation **1948** has a shape like a hook or a breaking wave, and a surface **1949** defines a wave-trough shape in front thereof, as can best be seen in cross-sections (*a*) and (*b*) of FIG. **7**. (Note that these cross-sections are as seen by an observer looking downwards, as indicated by arrows on the dotted lines showing the sectioning stations (*a*)-(*e*) extending between FIGS. **5** and **6**.

When clamp halves **1914** and **1916** are assembled together, the two formations **1948** nest together as shown in cross-sections (*a*) and (*b*) of FIG. **7**, each of the two formations **1948** being received in the trough-like recess defined by a surface **1949** of the other part, and on assembly of clamp **1910** together define an approximately circular-section opening **1951** between them. Opening **1951** decreases in diameter from the bottom of formations **1948** to the top of formations **1948** so that when a tapered portion **1952** of bolt **1920** advances into opening **1951** those parts of formations **1948** on opposite sides of portion **1952** move in opposite directions thus pulling faces **1926** and **1928** towards each other (and therefore clamping therebetween the panel **1912**).

To assemble clamp **1910**, nut/bolt assembly **1918** is engaged in one of the clamp halves (**1914** for example) with bolt **1920** passing through cutaway **1942** and the two parts **1914** and **1916** are then positioned one against the other, tapering porting **1952** being received between the two formations **1948**. Nut **1921** is located between and against the two formations **1946** which prevent it rotating as bolt **1920** is screwed upward (in the orientation shown in the Figures). The result is that as formations **1948** are urged outwardly by taper section **1952**, faces **1926** and **1928** are drawn together, compressing pads **1922** and **1924** and clamping panel **1912**. An external locknut (not shown) may if required also be provided on bolt **1920**, to be tightened against the outer surface of wall **1944**.

To balance the tendency of the upper ends (i.e. the ends remotest from formations **1948**) of parts **1914** and **1916** to splay outwards, there is in assembled clamp **1910** compressive contact between parts **1914** and **1916** at their lower ends and/or between parts **1914** and **1916** and bolt **1920** and/or between nut **1921** and formations **1946**.

The clamp **1910** as described above was disclosed by the present applicants in PCT International Publication No. WO 2010/146474. In that publication, several schemes were described by which the interlocking of parts **1914** and **1916** described above could be achieved. A first scheme, the one

incorporated in clamp **1910** as shown in FIGS. **2** to **6**, is shown in FIG. **7** (*a*) and (*b*). Item number **1950** refers to an area on the "crest" of formation **1948**. It is possible with suitable proportioning of parts **1914** and **1916** to arrange that area **1950** of one formation **1948** actually contacts the trough surface **1949** of the other part, so that once a certain degree of engagement of portion **1952** of bolt **1920** is achieved, the two parts **1914** and **1916** lock together. There may be gaps **1947** at the sides of the assembled clamp. With this scheme, the spacing between faces **1926** and **1928** can be very precisely specified and held, so that overtightening of the clamp on panel **1912** can be avoided.

Another possible scheme can be described by reference to FIG. **8**. FIG. **8** shows a section through a clamp **1910***a* having parts **1914***a* and **1916***a* corresponding to parts **1914** and **1916** of clamp **1910**. (Similarly, an item number in FIG. **8** with a suffix "a" denotes a part equivalent to an element of clamp **1910** with the same item number excluding the "a".) FIG. **8** is intended to be directly equivalent to FIG. **7**(*b*) although not to scale. Clamp **1910***a* has a different interlocking arrangement, inasmuch as each surface **1950***a* remains clear of adjacent surface **1949***a*. Bolt portion **1952***a* pushes formations **1948***a* apart, but movement together of parts **1914***a* and **1916***a* ceases when there is contact at points **1964**. In this scheme, formations **1948** are subject to bending stress once the clamp **1910***a* is assembled, and parts **1914***a* and **1916***a* press against each other at points **1964**. As with clamp **1910**, the spacing of the clamping faces (not shown) can be precisely specified and held.

Still another possible interlocking scheme can be described by reference to FIG. **9**. FIG. **9** shows a section through a clamp **1910***b*, with a third interlocking scheme. Clamp **1910***b* is generally the same as clamps **1910** and **1910***a* except for this third interlocking scheme, and the suffixes "b" indicate parts corresponding to equivalent parts similarly numbered (except without the "b") in the description of clamp **1910**. In this interlocking scheme, portion **1952***b* pushes formations **1948***b* apart as before, but surfaces **1949***b* and **1950***b* remain apart upon assembly and also there are gaps **1951** between parts **1914***b* and **1916***b*. In this scheme, the distance between the clamping faces is not precisely set, but instead the clamping force on a panel such as **1912** held between parts **1914***b* and **1916***b* depends on the distance to which bolt portion **1952***b* enters into the space between formations **1948***b*. This arrangement is not preferred as overtightening is possible, and this is particularly important where glass panels are to be clamped.

A fourth possible interlocking scheme can be described by reference to FIG. **10**. FIG. **10** shows a section through yet another clamp **1910***c*, with a fourth interlocking scheme. Clamp **1910***c* is generally the same as clamps **1910**, **1910***a* and **1910***b* except for its interlocking scheme, and the suffixes "c" indicate parts corresponding to equivalent parts similarly numbered (except without the "c") in the description of clamp **1910**. In this interlocking scheme, portion **1952***c* pushes formations **1948***c* apart as before, and surfaces **1949***c* and **1950***c* remain apart. However, surfaces **1966** on the formations **1948***c* and surfaces **1967** about each other, together with surfaces **1965**. This scheme leaves formations **1948***c* under bending stress when portion **1952***c* is fully home, but this is believed acceptable for such materials as stainless steel (for example) which do not exhibit significant creep over time and under load. This scheme was developed to provide improved alignment of the two clamp halves such as **1914***c* and **1916***c* after clamp assembly on completion of the assembly of the two parts.

However, each of these schemes has proven in practice to be only partly satisfactory, in each case for at least one of two reasons, namely ease of manufacturing and the ability to assemble a clamp with two clamp halves accurately in registration with each other and without distortion or unwanted displacement of any gaskets used between the clamping faces and a panel being clamped. What is meant by registration is that if two identical clamp halves (such as **1914** and **1916** of clamp **1910**) are assembled together in perfect registration, a drawing that is an elevation of the assembled clamp when seen looking in a direction normal to a clamped glass panel would show only one clamp half, the other being precisely obscured so as not to appear in the elevation. FIGS. **35** and **36** are elevations of clamp **1910** secured to a panel **1912**, looking in a direction, perpendicular to the plane of panel **1912**, where registration is not correct. Angular misalignment is shown in FIG. **35** and would mean that at least one wedge-shaped part of the further clamp half (here **1916**) would be visible in the elevation and lateral misalignment, shown in the similar view of FIG. **36**, would mean that some of the further clamp half (here again **1916**) would be visible along the whole of its length. Lack of correct registration means that there is some combination of lateral and angular misalignment of the clamp halves on opposite sides of the panel that clamp the panel (**1914** and **1916** in these examples).

The scheme of FIG. **10** has been found able to give good registration of the two clamp halves when they are in their final positions. However, during the assembly process, in which the two clamp halves **1914***c* and **1916***c* are assembled together with member **1952***c* and moved into engagement with a panel to be clamped, any initial misalignment of the two clamp halves may not be corrected until very late in, or the very end of, the process of their movement towards each other. The result may be distorting of rubber (or other) gaskets or spacers between the panel and the clamp halves **1914***c* and **1916***c* notwithstanding accurate final registration of the two halves. This can be very difficult to fix.

A surprisingly effective way in which this problem can be alleviated in clamps of the above described general type will now be described. FIG. **11** shows a first clamp half **9000** of two identical clamp halves that can be used in a clamp similar in its principle of operation to clamp **1910**, so that separate explanation of a clamp made using clamp halves **9000** is not required, except as set out below. FIGS. **12** and **13** show further partial views of clamp half **9000**. Face **9001** is a clamping surface analogous to face **1926** in clamp **1910** and **9003** is an axis along which an elongate locating component, such as a bolt with a tapered portion (not shown in FIG. **11**, but analogous to bolt **1920**) moves during assembly and extends in the assembled clamp. Clamp half **9000** has a wave- or hook-shaped first formation **9002**. This first formation and an identical second formation of the identical second clamp half perform the same function as formations **1948** in clamp **1910**: that is, as the locating component is moved lengthwise during assembly of the clamp the tapered portion moves between the first (**9002**) and second formations whereby to urge portions of them apart so that the first clamping surface **9001** and the second clamping surface comprised in the second clamp half move towards each other whereby to clamp a panel between them. On completion of this process, clamp half **9000** and the second clamp half arrange themselves generally as shown in FIG. **8** for clamp **1910**, namely with formation **9002** and its identical counterpart clear of each other generally as shown in FIG. **8** and contact between pairs of side wall surfaces **9019**. However according to the first

invention there is one important difference between clamp **1910** and a clamp made using two clamp halves **9000**, set out below.

A recess **9004** is formed in outer sloping face **9006** of formation **9000** and has a flat surface **9008** that is at least approximately parallel to bolt axis **9003** and precisely or nearly perpendicular to the face of a glass panel that is held between the two faces **9001** by the assembled clamp. Also provided is a triangular formation **9010** upstanding from a surface **9012**. Formation **9010** has a flat surface **9014** that is precisely or nearly parallel to wall **9008**. Further, formation **9010** and recess **9004** are so positioned and proportioned that the formation **9010** of each clamp half is received in the recess (the same as **9004**) of the other clamp half when two clamp halves **9000** are assembled together for use. Surfaces **9014** and **9008** act as guide surfaces while a panel is being clamped. Provided a surface **9008** of one clamp half abuts the surface of the other half corresponding to surface of **9014** during the clamping process, relative displacement in one direction of the two clamp halves from their intended positions is prevented at least in the vicinity of those guide surfaces **9014** and **9008**. That one direction is perpendicular to the movements of both the clamping surfaces and the locating component is prevented at least in the vicinity of those guide surfaces.

It will be realized that relative movement in the opposite direction is not prevented by such guide surface abutment. However, with suitable choice of the geometry of the two formations **9002** and a tapered bolt **9025** pushing them apart, a degree of sideways force is developed either continuously as formation **9002** and its counterpart in the other clamp half are urged apart, or if there is lateral misalignment. This pushes surfaces **9008** and **9014** into contact and so long as that force exists, holds them in contact. In this way, movement of the two clamp halves **9000** out of registration in either direction in the plane of formations **9010** and recess **9004** is prevented or alleviated, at least in the vicinity of the guide surfaces **9008** and **9014**. This is explained further below.

Also shown in FIG. **11** are a male formation **9020** and female recess **9022** so positioned and proportioned that the female recess **9022** of one clamp half **9000** receives the male formation **9020** of another clamp half **9000** when two clamp halves **9000** are assembled together. With suitably close fitting of formations **9020** in recesses **9022**, these too can assist in providing good registration and alignment of two assembled clamp halves **9000**. However, it is believed that having cooperating formations **9010** and recesses **9004** longitudinally at or close to the formations **9002** and working together due to the side force developed between formation **9002** is more important to good registration and alignment of the two clamp halves.

FIG. **16** is a schematic diagram illustrating the principle involved in a clamp **9500** made on the principle described above by reference to clamp half **9000**. It is a much-simplified and schematized cross-section normal to the length of elongate locating component (eg bolt) **9025** serving the purpose that is served by bolt **1920** in clamp **1910**. The section shows what is happening at the location (longitudinally along the length of component **9025**) of the two formations **9002** (represented by items **9002***a* and **9002***b*) in a clamp **9500** assembled from two clamp halves **9000** (represented by items **9000***a* and **9000***b*). Similarly to the arrangement shown for clamp **1910** in FIG. **8**, formations **9002***a* and **9002***b* are urged apart by a bolt **9025** tapered in a direction normal to the page (i.e. longitudinally of the clamp **9500**). The effect of this urging apart is to draw clamp halves **9000***a* and **9000***b* together, with contact occurring at mating surface pairs **9019***a* (corresponding to sidewalls **9019** of clamp half **9000**) and at mating surface pairs **9501**, which is intended to schematically represent the two pairs of mating surfaces **9014** and **9008** of clamp half **9000**. Depending on the angle "a", a sideways-directed thrust is developed that urges the mating surfaces **9501** together, so that during assembly of clamp **9500**, registration of the two clamp halves **9000***a* and **9000***b* is maintained due to sliding abutment of the guide surface pairs **9501**. Formations equivalent to **9020** and **9022** (not shown in FIG. **16**, and at a different longitudinal location on clamp **9500**) assist in maintaining registration and alignment of the two clamp halves **9000***a* and **9000***b*. The side thrust can be varied by suitable choice of angle "a" and by suitable shaping the formations **9002***a* and **9002***b* and controlling their arcs of contact with bolt **9025** as set out below. More detailed information on obtaining the side thrust to maintain registration during clamp assembly is now given, by reference to FIGS. **37-40**.

FIG. **37** is a cross-section of two of the clamp halves **9000**, with some hidden lines omitted, in the relative positions they would occupy in an assembled clamp, the cross-section of each clamp half being taken at station "J-J" and looking in the direction of arrow "K" shown in FIG. **13**. FIG. **38** is the same in content and viewpoint as FIG. **37** except that clamp halves **9000***e* the same as clamp halves **9000** except for modified versions **9002***e* of formations **9002** are shown.

FIG. **39** is also the same as the same in content and viewpoint as FIG. **37** except that clamp halves **9000***f* that are the same as clamp halves **9000** except for further modified versions **9002***f* of formations **9002**, are shown. The arrangement of FIG. **39** is treated first. An elongate locating component **9070***f*, seen in cross-section, is shown schematically only, as two circles representing the larger and smaller diameters at the ends of a linearly tapered end portion **9071***f*. Each formation **9002***f* has a flat surface **9072***f*. The two flat surfaces converge in the direction of advance of locating component **9070***f* shown by arrow **9073***f* (FIG. **40**), and are inclined to the mating side surfaces **9019***f* (corresponding to surfaces **9019** of clamp half **9000**) as shown by angle "Q" between a perpendicular to the surface **9072***f* and that plane.

If angle "Q" were to be 90 degrees, then as component **9070***f* advanced, the contact forces between it and surfaces **9072***f* would be perpendicular to the plane of surfaces **9019***f* and, although the two clamp halves **9000***f* would be drawn together as required, there would be no urging together of the pairs **9008***f* and **9014***f* of guide surfaces. Hence any initial lateral misalignment between clamp halves **9000***f* (i.e. across the page as FIG. **39** is drawn) would not be corrected. However, if "Q" is less than 90 degrees as shown, a side thrust is generated and the guide surface pairs **9008***f* and **9014***f* are drawn together and held together as component **9070***f* advances towards its final position. As the surfaces **9072***f* move apart, the lines of contact between them and tapered portion **9071***f* move also.

Although usable, the arrangement in FIGS. **39** and **40** is not preferred as there is line contact between surfaces **9072***f* and tapered portion **9071***f* of component **9070***f*.

In FIGS. **37** and **38**, locating component **9070** is omitted, but the larger and smaller diameters of the ends of its linearly tapered portion are shown in dotted lines. Formations **9002** have conical surfaces **9076**, that when component **9070** is advanced to its final position are designed to abut the tapered conical surface of component **9070**. That is, line contact (as in the arrangement of FIG. **39**) is avoided in favour of contact over significant surface area. It is thought that before this final state is reached, when component **9070** is advancing between, and pushing apart, formations **9002** the point (or line) of contact between each surface **9076** and component **9070** will

vary according to the remaining gap between mating pairs of surfaces **9019** and any lateral misalignment, but that sidethrust will be generated and guide surface pairs **9008** and **9014** urged into abutment, so long as the contact surface **9076** is mostly on the side of the axis **9077** of component **9070** that is closer to the recess **9004** that contains guide surface **9008**. This appears to apply even if the conical surface extends more than 90 degrees (as shown by angle "R" in FIG. **37**) around component **9070** from the plane of planes **9019**.

However, it is preferred that angle "R" be equal to or less than 90 degrees, as shown by the angle "S" in FIG. **38**. This is not only to ensure that any sidethrust generated by contact between component **9070** (or **9070***e* in the arrangement of FIG. **38**) is in the direction required to bring the guide surface pairs (**9008**/**9014**, **9008***e*/**9014***e*) into abutment, but also because it has been found that values of "R" less than 90 degrees make initial assembly of clamp halves such as clamp halves **9000** and a matching locating component easier.

Of course the conical surfaces **9076**, **9076***e*, must extend sufficiently far around component **9070** or **9070***e* to ensure the thrust required to close the clamp on a panel is also generated.

Calculating the contact points (or lines) between a tapered locating component such as **9070** or **9070***e* and two conical surfaces such as **9076** or **9076***e* for specified degrees of misalignment and separation requires only geometry, and does not require any inventive step. By such means, the necessary angular extent of the conical surfaces can be determined for any practical clamp half design.

The sizes and proportions of recess **9004** and formation **9010** are desirably chosen so that the two clamp halves **9000** are forced into such good alignment and registration during assembly and before the two clamps assume their final positions, and preferably before any significant distortion or lateral movement of gaskets (not shown) between the panel being clamped and faces **9001** (not shown) can occur.

Formations **9010** are not intended to "bottom" in recesses **9004** in use, i.e. face **9011** of formation **9010** is not intended to contact face **9017** of recess **9004**. Rather, it is intended that completion of assembly together of two clamp halves **9000** be characterized by contact between side surfaces **9019**.

The combination of this locking scheme and the use of formations **9010** and recesses **9008** is surprisingly advantageous not only because of the assembly advantages described above, but because it has manufacturing advantages also, compared to the schemes described by reference to FIGS. **8**, **9** and **10**. It has been found difficult to obtain satisfactorily accurate assembly with normal manufacturing tolerances, including those applicable to investment casting, which can be used for the clamp parts. Specifically, with the scheme of FIG. **10**, getting accurately simultaneous contact between surfaces **1966** and **1967** as well as surfaces **1965** has been difficult. And with the scheme of FIG. **9**, getting satisfactorily small gaps **1951** has been difficult. The scheme of FIG. **7** proved similarly difficult to implement.

Despite the advantage of clamp half **9000** in this respect (it is similar for manufacturing purposes to the simple scheme of FIG. **8**) some final adjustment after casting (If that forming method is chosen) using a grinder, possibly hand held, may nevertheless be required, but this is not particularly difficult as the formation **9010** in particular is readily accessible. Material can be ground off it easily if required, or it can be tapped with a hammer or the like to make a burr, effectively slightly changing its shape.

An alternative approach to proving improved registration and alignment of two clamp halves would be to provide on clamp half **9000**, instead of formation **9010** and recess **9004**, male and female locating formations (not shown) that are similar to formations **9020** and **9022** but located longitudinally near the "hook" formations **9002**. The male locating formation of one clamp half would have only limited lateral clearance (hence freedom to move laterally) in its receiving female locating formation, so as to force two such clamp halves into registration at the locations of the formations **9002**. However, in practice the need to provide some manufacturing clearance would limit the effectiveness of this scheme compared to that of clamp half **9000**, including during the process of engagement of the two clamp halves, before they reach their final positions.

A further improvement may be incorporated in clamps such as clamp **1910** and clamps based on clamp halves such as clamp half **9000**. This is explained here by reference to clamp **1910**, but without any intended limitation to that clamp only. If the surfaces of formations **1948** that form opening **1951** and the surface **1952** of bolt **1920** are straight tapered, i.e. conical, in the parts that are engaged by bolt **1920** in use, contact between bolt **1920** and formations **1948** tends to be point contact, or at best line contact over short lengths, during engagement of the bolt **1920** in opening **1951**, as there can be only one point at which accurate mating of male and female conical surfaces occurs. This can make for unpredictable movement during assembly. To alleviate this, the male surface **1952** of bolt **1920** that in use enters opening **1951**, may be given a slightly "barrel" shape as shown in FIG. **14**, instead of a simple conical shape. Alternatively, those parts of the female surfaces that form opening **1951** may be shaped with a correspondingly slight inward bulge along their length. This is shown at item **7067** in FIG. **15**, where either of these measures is believed to offer more line contact and a better "feel" during assembly. This improvement could be applied to clamp half **9000**. A bolt **9025** made to be used in assembling clamp halves **9000** could incorporate the improvement described above by reference to FIG. **14**.

A further example of application of the new locking arrangement set out above will now be given.

FIG. **23** shows a clamp **7000** that can be mounted on an edge of a concrete slab **7001**, or deck, beam or like structure, being secured by bolts or screws (not shown, and by way of example) to both an upward facing (typically horizontal) surface **7002** of that structure and a side face **7004** of that structure as shown in FIG. **25**. Clamp **7000** has two clamp halves **7006** and **7008** that clamp together using the scheme described above in relation to clamps made using clamp halves **9000** and that hold a panel (not shown) in a gap **7003**. Clamp halves **7006** and **7008** are identical in respect of the parts that effect their clamping together (see below) but otherwise differ from each other. Clamp half **7006** has a flange **7010** that extends laterally and that in use is placed immediately above surface **7002** (possibly with a gasket (not shown) or layer of sealant interposed between the surface **7002** and the flange **7010**), whereas clamp half **7008** has a depending portion **7012** that in use lies against the side face **7004** (again with the possibility of a gasket or layer of sealant (not shown) being interposed).

Referring to FIGS. **29** and **31**, the following items correspond to parts of clamp half **9000** as listed below:

9004 corresponds to items **7026**, **7027**;
9010 corresponds to items **7024**, **7025**;
9002 corresponds to items **7028**, **7029**
9020 corresponds to items **7030**; **7031**
9022 corresponds to items **7032**, **7033**.

The locking arrangement for two clamp halves **9000** having been described above, it need not be repeated here.

One modification shown is ribs **7036**, **7037** in clamp halves **7006** and **7008** respectively, which both strengthen the structure generally and act to prevent rotation of the nut (not shown, corresponding to nut **1921** of clamp **1910**) on bolt **7022**.

To secure clamp **7000** in place on slab **7001** (for example), suitable fasteners (such as bolts or screws, not shown) are passed horizontally through holes **7014** in depending part **7012**, and others are passed vertically through slots **7016** in flange **7010**, all being secured within slab **7001**.

For enhanced appearance, clamp half **7008** is provided with a cover plate **7018** that once secured in place on clamp half **7008** lies flush with the surface of clamp half **7008** and conceals heads (not shown) of the fasteners that pass through that clamp half into slab **7001**. Clamp half **7006** is also shown as provided with a cover plate **7020** that once secured in place on clamp half **7006** lies flush with the upper surface of flange **7010** and conceals heads (not shown) of the fasteners that pass through flange **7010** downward into slab **7001**.

FIG. **30** shows the two clamp halves **7006** and **7008** assembled, using a bolt **7022** that serves the same purpose as bolt **1920** in clamp **1910**. Bolt **7022** must be, and is, shorter than bolt **1920** so as to lie above a surface (such as **7002**) on which clamp **7000** is mounted. It may have an Allen key-type recess (not shown) or a simple transverse slot to enable rotation by an Allen key or screwdriver when assembling the clamp halves **7006** and **7008** together. The clamp halves **7006** and **7008** are generally assembled together before mounting to the slab **7001** (or other structure).

Clamp **7000** has the advantage that it can increase the room available on a balcony deck or the like by allowing secure installation of panels at the very edge of the balcony or deck. Clamp **7000** is for at least this reason considered inventive in itself and may be provided not only with the new locking arrangement described herein, but any of the earlier ones described above.

It will be apparent that two clamp halves **7006** could be used to provide a clamp **8000** suitable for deck mounting. Such a clamp **8000** is shown in FIGS. **17** to **21**, with two such clamp halves **7006***a* and **7006***b*. Cover plates **7020***a* and **7020***b* corresponding to cover plate **7020** of clamp **7000**. are shown in FIG. **17** and are left off in FIG. **18**. Clamp **8000** is shown mounted to a deck or slab surface **8001** in FIG. **21**.

The principle described above by reference to FIGS. **14** and **15** is illustrated in FIG. **32**, which shows a clamp **9700** made with two clamp halves **9000** and a bolt **9077**. In the detail section two formation **9002** are shown and are "barreled" on surfaces **9762** rather than straight tapered.

As described above, clamps **7000** and **8000** have cover plates (**7020** and **7018** in the case of clamp **7000** and **7020***a* and **7020***b* in the case of clamp **8000**) that in use conceal fasteners by which these clamps are secured to surfaces or structures. A practical problem with such cover plates is that once secured in place, they can be difficult to remove if the need arises. If they fit closely in their recesses and if their external surfaces are truly (or nearly) flush with surrounding clamp surfaces, as is desirable for attractive appearance, there is nothing to grip to enable prising out of the plate if its removal is required.

There is now disclosed an improvement to clamps that addresses this problem. It is considered applicable not only to clamps of the types **7000** and **8000** described above, but generally to clamps for panels where a cover plate is provided to conceal fasteners, whether those fasteners hold the clamp together or hold it to a structure. For example, in the "A" publication of Australian patent application No. 2006251996 (which is incorporated herein in its entirety by reference) clamps are described with fastener-concealing cover plates—see for example the cover plate designated item **38** of the clamp designated item **30** in that publication. The improvement described below is applicable to clamps such as these also, and more generally to clamps for panels having fasteners that it is desirable to conceal behind one or more cover plates. More specifically, because this improvement is independent of the scheme by which the two clamp halves are secured to each other and a panel, it can be applied to clamps the same in general arrangement as clamps **7000** and **8000** but with the earlier locking schemes described by reference to FIGS. **7**, **8**, **9** and **10**.

The general principle of the improvement will be described by reference to a clamp similar to clamp **8000**. Referring to FIG. **18**, showing clamp **8000**, recesses **7933***a* and **7933***b* are provided to receive the cover plates **7020***a* and **7020***b* respectively so as to conceal heads of fasteners (not shown) that are installed through holes **7935***a* and **7935***b*. Lands **7937***a* and **7937***b* extend around openings **7935***a* and **7935***b* respectively. Cover plates **7020***a* and **7020***b* are placed in recesses **7933***a* and **7933***b* respectively and secured on lands **7937***a* and **7937***b* respectively using an adhesive such as for example a silicone-type adhesive. The completed appearance shown in FIG. **17** is thus obtained. The difficulty is to remove cover plates **7020***a* and **7020***b* when required.

FIG. **33** shows a clamp **8001** that is a modified version of clamp **8000** incorporating the improvement. FIG. **34** is a partial sectional view of clamp **8001**, taken at station "**122-122**" in FIG. **33**. Clamp **8001** has recesses **8003***a* and **8003***b* that, just as recesses **7933***a* and **7933***b* receive cover plates **7020***a* and **7020***b*, receive cover plates **8005***a* and **8005***b*. Using recess **8003***b* as an example that is representative also of recess **8003***a*, it has a first land **8007***b* that is similar to land **7937***b* except that it extends only partway around fastener opening **8009***b* within recess **8003***b*. A second land **8011***b* extends the rest of the way around opening **8009***b* and intersects land **8007***b* at a small angle. The intersection between lands **8007***b* and **8011***b* forms a slight ridge **8013***b*. Land **8007***b* is positioned and proportioned such that cover plate **8005***b* can be positioned on, and adhered to, land **8007***b* so that external surface **8013***b* of cover plate **8005***b* is flush with surrounding surfaces of clamp **8001** in the same way as cover plate **7020***b* is flush with surrounding surfaces of clamp **8000**. To install cover plate **8005***b*, adhesive is placed on at least one of plate **8005***b* (specifically its inward facing surface) and land **8007***b* and plate **8005***b* is then placed in position in recess **7933***b*. Plate **8005***b* then adheres to land **8007***b*, but there is a wedge-shaped clearance **8015***b* between plate **8005***b* and second land **8011***b* within recess **8003***b*. If it is required to remove plate **8005***b*, plate **8005***b* can be pressed inward at such a location that the bond between plate **8005***b* and land **8007***b* is broken or at least plate **8005***b* and land **8007***b* can be pulled apart, and plate **8005***b* rotates on ridge **8013***b*, the clearance **8015***b* between plate **8005***b* and second land **8011***b* being reduced. The effect is that an edge **8023***b* of plate **8005***b* leaves recess **8003***b* far enough for plate **8005***b* to be easily gripped and removed from recess **8003***b*. FIG. **34** shows a force (represented by arrow **8017**) applied to cover plate **8005***b* on an opposite side of ridge **8013***b* from land **8007***b* (that is, outside the periphery of the land **8007***b*) so as to rotate plate **8005***b* from its normal installed position (shown both in solid lines) to a position (shown in chain-dotted lines) from which it can be removed).

It will be appreciated that second land **8011***b* is strictly not necessary, and the function of first land **8007***b* could be served by several smaller lands in combination. (The term "land" normally refers to a surface, but the term is here intended also

to include very small areas that act in effect as contact points.) What is essential to this improvement to clamps is that there be one or more such lands within a recess against which land or several lands in combination a cover plate abuts when in its installed position and to which the cover plate can be adhered to secure the cover plate within the recess, with those surfaces being so proportioned and so positioned within the recess that a first portion of the cover plate can be moved inward into the recess by application to the cover plate of a force directed outside the a periphery of the land or lands whereby a second portion of the cover plate emerges from the recess.

This improvement is considered an invention in its own right and, although described by reference to a clamp of the type shown as item **8000** (clamp **8001** simply being a clamp incorporating the improvement but otherwise identical to clamp **8000**), could also be applied to a clamp such as clamp **7000** to make cover plates **7020** and also **7018** more easily removable. Similarly, the improvement could also be applied to other clamps in which cover plates are used to disguise parts such as fasteners, such as for example clamps otherwise similar to clamp **30** of the "A" publication of Australian patent application No. 2006251996.

Still other embodiments and variations, within the scope of the described invention, will in the light of the above description readily suggest themselves to persons skilled in the art.

The invention claimed is:

1. A clamp securable to a panel, the clamp comprising:

a first clamping member that comprises a first clamping surface;

a second clamping member that comprises a second clamping surface, wherein the second clamping surface faces the first clamping surface; and

an elongate locating component whose length extends longitudinally in the clamp between the first and second clamping members; wherein:

firstly the first clamping member comprises:

a first formation that extends toward the second clamping member and circumferentially partway around a tapered portion of the elongate locating component, wherein a first free ended portion of the first formation lies laterally on an opposite side of the elongate locating component from the first clamping surface, and two first sidewalls formed on opposing sides of the first formation and facing the second clamping member;

secondly the second clamping member comprises:

a second formation that extends toward the first clamping member and circumferentially partway around the tapered portion of the elongate locating component, wherein a second free ended portion of the second formation lies laterally on an opposite side of the elongate locating component from the second clamping surface, and two second sidewalls formed on opposing sides of the second formation each second sidewall facing one of the first sidewalls comprised in the first clamping member;

thirdly, the tapered portion of the elongate locating component contacts the first and second formations between the respective free ended portions thereof, and when advanced longitudinally moves the first and second free ended portions between:

a first position, wherein the tapered portion is partially inserted between the free ended portions, such that first clearances exist between the first and second free ended portions and the second and first clamping members, respectively, and second clearances exist between mutually facing first and second sidewalls; and

a second position, wherein further insertion of the tapered portion between the first and second free ended portions closes the second clearances while the first clearances remain unclosed; and

fourthly, the first clamping member comprises a male guide formation and the second clamping member comprises a female recess, the male guide formation being located longitudinally at the first formation and being received within the female recess while the free ended portions of said first and second formations are between said first and second positions thereof, whereby contact between the male guide formation and the female recess limits relative movement of the first and second clamping members in a lateral direction approximately parallel to the first clamping surface.

2. The clamp according to claim **1** wherein the first and second free ended portions of the first and second formations are so positioned relative to the elongate locating component that during movement between their first and second positions the first and second free ended portions are laterally pushed apart partially normal and partially parallel to the first clamping surface and relative movement of the first and second free ended portions parallel to the first clamping surface is resisted by contact between the male guide formation and a surface within the female recess that is approximately normal to the first clamping surface.

3. A clamp for clamping panel-shaped members, comprising:

a first clamping member that comprises a first clamping surface;

a second clamping member that comprises a second clamping surface, wherein the second clamping surface faces the first clamping surface; and

an elongate locating component whose length extends longitudinally in the clamp between the first and second clamping members; wherein:

firstly the first clamping member comprises:

a first formation that extends toward the second clamping member and circumferentially partway around a tapered portion of the elongate locating component, wherein a first free ended portion of the first formation lies laterally on an opposite side of the elongate locating component from the first clamping surface, and two first sidewalls formed on opposing sides of the first formation and facing the second clamping member;

secondly the second clamping member comprises:

a second formation that extends toward the first clamping member and circumferentially partway around the tapered portion of the elongate locating component, wherein a second free ended portion of the second formation lies laterally on an opposite side of the elongate locating component from the second clamping surface, and two second sidewalls formed on opposing sides of the second formation each second sidewall facing one of the first sidewalls comprised in the first clamping member; and

thirdly, the tapered portion of the elongate locating component contacts the first and second formations between the respective free ended portions thereof, and when advanced longitudinally moves the first and second free ended portions between:

a first position, wherein the tapered portion is partially inserted between the free ended portions, such that

first clearances exist between the first and second free ended portions and the second and first clamping members, respectively, and second clearances exist between mutually facing first and second sidewalls; and

a second position, wherein further insertion of the tapered portion between the first and second free ended portions closes the second clearances while the first clearances remain unclosed; and

fourthly, the first clamping member comprises a laterally extending flange with a first opening adapted to receive therein a longitudinally extending first fastener for securing the flange to a first support surface; and the second clamping member comprises a longitudinally extending portion with a second opening adapted to receive therein a laterally extending second fastener for securing the longitudinally extending portion to a second support surface that is approximately perpendicular to the first support surface.

4. The clamp of claim **3** wherein the longitudinally extending portion has a face oriented to in use abut the second support surface.

5. The clamp of claim **4** wherein the first and second clamping surfaces are approximately co-planar with said face oriented to in use abut the second support surface.

6. The clamp of claim **3** wherein the first and second formations overlap with each other longitudinally.

7. The clamp of claim **3** wherein the clamp further comprises a nut held non-rotatingly captive between the first and second clamping members and with which a threaded section of the locating component is engaged, whereby the elongate locating component and the tapered portion thereof, when rotated, are movable longitudinally in the clamp.

8. The clamp of claim **3** wherein the first and second clamping members contact at least one of each other and the elongate locating component at a first location in the clamp that is remote longitudinally from the first and second clamping surfaces; and

the first and second formations are located at a second location in the clamp that is less remote longitudinally from the first and second clamping surfaces than the said first location in the clamp.

9. The clamp of claim **3** wherein the longitudinally extending portion comprises a recess within which a head end of a second fastener extending through the second opening is receivable and further comprising a cover that is close-fittingly receivable in the recess whereby to conceal the head end.

10. The clamp of claim **9** wherein an outer face of the cover in use lies flush with an external surface of the longitudinally extending portion.

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